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The Physiotherapy Review

Volume 15 Number 6

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Artificial Fever Therapy

H. W. Hefke, M. D.

Physicians and laymen often consider fever a dangerous and undesirable symptom of many diseases. It is thought, indeed, that a fever between 104° and 106.5° F. is in itself very harmful to a patient. Antipyretics have been and are still being used for the main purpose of lowering the body temperature of a sick individual. The idea that fever might be part of the defense mechanism of the body against invading micro-organisms, and that it might be a friend and not an enemy, is gradually replacing the old belief.

The credit of introducing artificial fever as therapeutic agent belongs to Wagner-Jauregg, who used malaria fever in the fight against the terrible and ordinarily hopeless syphilis of the central nervous system. The definite advance, which this type of therapy represented, was slow in being recognized. His great scientific contribution was awarded the Nobel Prize.

It took time to realize that the fever alone might be the one factor responsible for the good results. Soon other means of inducing it were tried, such as relapsing fever, or injecting a typhoid vaccine. Because the reactions thus obtainable were difficult to control and were often not sufficient, methods were sought which would employ physical agents for the purpose of elevating the body temperature to any desired degree, and which would maintain it at a certain level. Hot-water baths, hot air, high frequency diathermy, radiothermy, and air-conditioned, electrically-heated cabinets have been used for this purpose. There seems to be no reasonable doubt that the therapeutic effect is the same as long as the temperature of the patient remains elevated to a certain degree for a certain time. Any apparatus which fulfills that requirement may be used. The method. however, which is least dangerous and most comfortable for the patient, is the method of choice.

During the last two years the Kettering Hypertherm, developed by Simpson and co-workers at Dayton, Ohio, has been used at the Milwaukee Hospital. It is an air-conditioned, insulated cabinet (see illustrations), in which the patient's body, with the exception of his head, is surrounded by circulating, humidified hot air. The temperature of the air is usually around 140° F. and the automatically controlled humidity around thirty-eight percent. The air is heated by three electric heaters and circulates in the cabinet by means of electric blowers. Two side doors in the cabinet allow the attendant to inspect the patient's skin, to cover the body with blankets when necessary, and to take the rectal temperature. Very little trouble has been encountered from a mechanical point of view.

Milwaukee Hospital, Milwaukee, Wis.

It is not difficult to learn how to "run" this apparatus, and yet the nurse in charge of such a treatment has a very responsible position. She remains with the patient during the entire treatment, which is usually eight hours, including the time it takes to raise the body temperature to the desired level, to maintain it, and to allow it to fall to a normal level. She has to make the patient feel as comfortable as possible throughout this more or less trying ordeal; she has to be on the look-out continuously for undesirable complications; she has to administer the necessary sedatives, and the necessary amount of fluids; and she has to take care of all the other nursing duties. And, last but not least, she often has to be a good psychotherapist, one who maintains the patients coöperation. Each patient needs and must have his own nurse.

In selecting patients for fever therapy the same principles must be applied as for the risk of a major surgical operation. A careful physical examination with special consideration of the cardio-vascular system is absolutely necessary. The reaction of the body to high maintained fever would be dangerous in many cases of cardio-vascular disease, old age, exophthalmic or toxic goiter, tuberculosis and other diseases. With careful selection of the patients by the physician, there should be only a very limited number of heat-accidents, although heat stroke, collapse, tetany and, very rarely, deaths have been reported. About eight hundred treatments have been given at the Milwaukee Hospital without any mortality and with very few, mostly inconsequential, complications.

Not all patients who begin fever therapy are able to finish the prescribed series of treatments. There are certain people who cannot "take it"; they lack willpower to go through with them and have to be removed from the cabinet because they become unmanageable. Without the coöperation of the patient and his will to get well, the treatments have almost always to be discontinued.

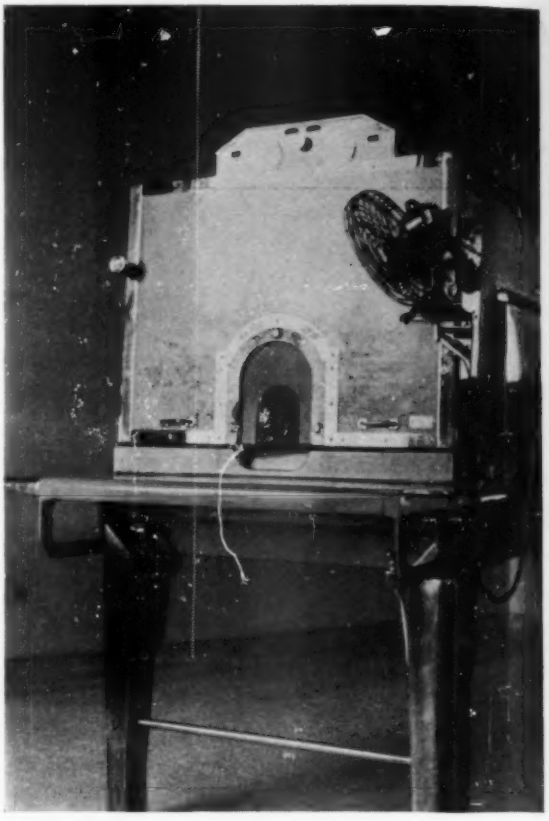
The average patient feels somewhat exhausted at the end of the treatment and possibly the next day. The greater percentage, however, is able to work the day following the treatment. In most cases, it is not necessary for the patient to remain at the hospital for the night.

There are definite physiological reactions of the body to temperature. The pulse rate, which rises with the temperature, ranges between one hundred and twenty and one hundred and forty beats per minute; there are changes in the blood pressure, and there is a definite leukocytosis. Other changes are of less importance.

When the pulse reaches one hundred and sixty, the treatment is usually interrupted. Persistent cyanosis and signs of shock also necessitate removal of the patient from the cabinet. It has been very rarely necessary to administer heart stimulants or oxygen. Tetany, which is occasionally encountered, may be checked by a hypodermic or intravenous injection of calcium. Heat exhaustion is combated by a rather large amount of a 0.6 per cent salt solution.

In order to facilitate the discomforts of the patient, nembutal, in doses of one and one-half or three grains, is given just before starting the treatment. When the patient becomes restless, usually in thirty or forty-five minutes, codein sulphate, dilaudid, or morphine is given hypodermically. These hypodermic injections are often repeated before the end of the session. When the temperature of the patient has risen to the desired level, between 104° and 106.8° F., the body is covered with blankets and the temperature of the cabinet is maintained only high enough to assure as little change in body temperature as possible.

During the period of maintenance of the fever, everything is done for the comfort of the individual. A fan is directed towards the head, the face is cooled by rubbing it with ice, the blankets are changed when necessary, and the position of the body in the cabinet may be changed.



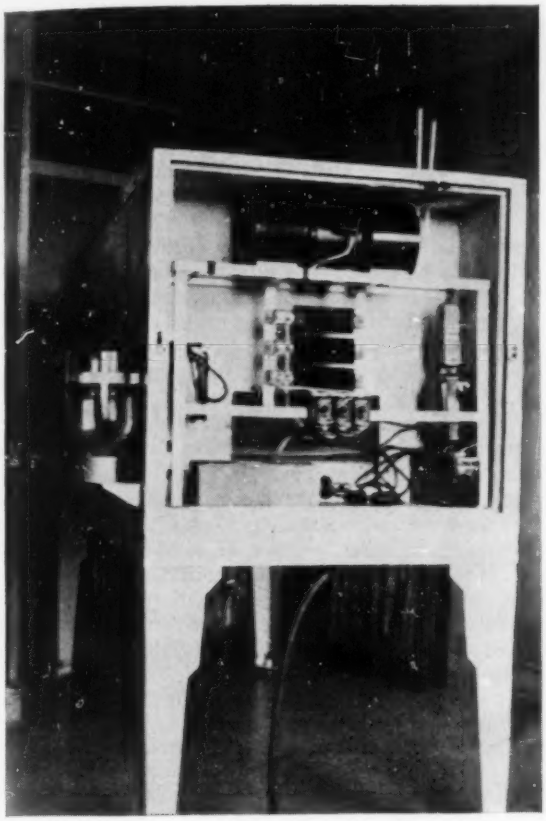
SYPHILIS AND GONORRHEA

Syphilis and gonorrhea are the two diseases which seem to be most responsive to fever therapy. A great number of statistics and sufficiently extensive follow-up studies have as yet not been reported. The time of weighing the value of malaria against that of physically induced fever has not yet come. From reports in the literature and our experience, it may be said that the results in the treatment of syphilis of the central nervous system, by means of the Kettering Hypertherm, may well stand comparison with the results of malaria therapy. In a few of our cases, it has been found that physically induced fever has greatly benefited patients in whom malaria treatment had been unsuccessful for some reasons. One may further say that the treatment has less mortality than malaria.

All cases of syphilis are given a series of ten treatments, each consisting of five hours with a rectal temperature maintained between 105° and 106° F. The treatments are given in weekly intervals and antisyphilitic chemicals are administered on the day of the treatment. In most cases, some improvement in the symptoms of paresis and tabes may be looked for after a few treatments. The improvement may take place slowly even after the series of treatments is finished. Reversal of Wassermann and Kahn reactions in the blood and spinal fluid may not be demonstrated until after several months. Seventy-five per cent of Simpson's patients with paresis obtained complete clinical remission. His results in a group of taboparetics and tabetics were also very good. It is of interest to note that tabes is rather unamenable to malaria therapy. It is also noteworthy that tabetic pains which have been almost incurable previous to fever therapy may be abolished in practically all cases. Congenital syphilis has been very difficult to treat, but there is reasonable evidence to believe that it also may be amenable to fever therapy, more so than the previously used treatment. In asymptomatic neurosyphilis and so-called blood-Wassermann-fast cases, the results are at least as good as those achieved by malaria inoculation. Syphilis of the eye is greatly benefited and is often cured by this method; but it remains to be demonstrated, whether or not it is of value in the treatment of the primary or secondary stage.

Gonorrhea might seem to be too unimportant a disease to be treated by such comparatively severe means, but the complications of this disease and the chronic stages have been very difficult to eradicate. Chronic pelvic disease in the female with or without operation has meant misery to many women. And in men, too, there is a number of very serious sequences of a gonorrhea. Beneficial effect of any fever has been observed by many physicians for many years; but not until artificial fever therapy, induced by physical means, was introduced, did the real value of fever in the treatment of this disease become apparent. The studies of Warren, Boak, and Carpenter on the thermal death time of the gonococcus have definitely demonstrated that it may be killed by a certain number of hours at a certain temperature. Then, if a culture of the gonococcus is made from a patient and its thermal death time determined, it will take the same amount of temperature to kill the organism in the body of the patient.

Because the determination of the thermal death time of the gonococcus is not a simple matter and because the necessary number of hours often exceeds the limits of tolerance for a human being, the routine treatment of gonorrhea by artificial fever is given by a modified method. The temperature of the patient is maintained between 106° and 106.8° F. for six hours, and treatments are given with intervals of only two or three days. When the patient is able and willing to take the prescribed treatments, a cure can be obtained in practically all cases. Gonorrhea in males seems to respond better than in females. Desjardins, Stuhler, and Popp of the Mayo Clinic have reported that all the male pa-



tients who cooperated faithfully were cured, while only the large majority of female patients were cured by this method in much less time than by the methods heretofore in vogue. In their experience the average number of sessions of fever required to effect a cure was 5.4. In our experience in Milwaukee, during the last eight months, the average number of treatments necessary for a cure in males has been three. In a few patients, only one treatment was necessary, in the greatest number, two, and in a few, more treatments. In females, three to five treatments seem to be the average number of sessions before the gonococcus disappears.

The results in gonorrheal arthritis are very remarkable and almost astonishing. One may safely say that rather immediate, lasting relief and cure can be obtained in ninety per cent of the acute and subacute cases. In chronic cases this percentage will, of course, drop due to the presence of actual destruction of joints. Many of the undesirable end results of pelvic gonorrhea in women, such as chronic salpingitis, sterility, chronic pelvic infection, etc., may unquestionably be prevented by fever therapy when it is used at the onset of these complications. Acute, non-complicated gonorrhea may be treated by this method, which is believed to shorten the course of the disease considerably and to prevent complications. The main indication, however, is the presence of complications and the chronicity of the disease. There is no doubt that the introduction of fever therapy in the treatment of gonorrhea means a new and very important addition to the therapeutic armamentarium.

OTHER DISEASES

Because early results seemed to be promising, fever therapy has been used rather extensively in the treatment of rheumatic diseases, especially in rheumatoid (or atrophic) arthritis. It was soon apparent that hypertrophic arthritis could not be benefited. However, the experience of many physicians during the last few years seems to show that too much had been hoped for in the treatment of rheumatoid arthritis. There are occasionally brilliant results even in rather advanced cases. Unfortunately, the average patient with an advanced rheumatoid arthritis is benefited temporarily and only to a limited degree. When the disease is not too severe or too long standing, fever therapy will be of great value. One may say that in one third of the suitable patients, good results may be achieved; in another third, there is some relief; and in the other third, there has been no help. If we were able to determine the response to fever beforehand, it would be of great value in the treatment of the many thousand sufferers. As it is today, one must be satisfied to point out the limitations of the method and one may advise a trial series which usually consists of three or four treatments, each lasting from four to five hours, at a temperature between 104° and 105° F., with an interval of one or two weeks. Many times physician and patient will be disappointed, but the rather brilliant results in some patients make one try again and again. Adequate medical and orthopedic treatment, together with physical therapy, must, of course, be used; but it has almost always been used with no avail.

Other so-called "rheumatic" diseases, as neuritis and muscular rheumatism, have been favorably influenced by artificial fever, when the regular means of medical treatment had failed. The treatment is planned similar to that of rheumatoid arthritis. Chorea in children, which is also considered a rheumatic disease, seems to be greatly improved or cured in the majority of the cases. Most children after six years of age seem able to stand the treatments fairly well.

It seems that hyperpyrexia is an aid in the treatment of intractable bronchial asthma, when relief has been impossible by all other recognized means of medical treatment.

Some physicians have reported rather encouraging results in multiple sclerosis. It had been known that the injection of typhoid vaccine had in certain cases led to definite improvement, and it was thought that a better controlled fever, as that induced by physical means might prove even more advantageous. In our few series of cases, there has been only a small percentage of improvement which has lasted for any length of time. Before anything definite may be said about the value of such treatment, a greater number of patients will have to be treated and followed up. At present these treatments must be considered purely experimental.

A great deal of work remains to be done. The physiological changes that occur during and after fever are not yet accurately understood. There remains the necessity of evaluation of artificial fever based on many series of carefully observed patients. Fever conferences are held annually to exchange experiences and ideas. There can be no doubt that hyperpyrexia has a very definite place in the treatment of human disease. It is desirable to have this work continue in hospitals under the supervision of especially trained physicians and nurses. Unfavorable or even disastrous results may be the outcome of such treatments administered by an inadequately trained personnel. There is a great danger that too much emphasis may be placed on the fever machine, whatever type it might be, and not enough on the men or women who are responsible for its use.

Causes and Treatment of Coccygodynia

Custis Lee Hall, M. D.

Coccygodynia, or painful coccyx, is a severe coccygeal pain affecting the structure of the coccyx and the attached nerve supply, which is of fairly common incidence, and is found most often in women. It is often associated with neurasthenia and hysteria. It may be the result of direct or indirect trauma, such as falls, kicks, and bruises. There is another group of cases in which the causation is either obscure or is the result of either pelvic or rectal disorders, or may be associated with lesions of the lumbrosacral region or the lumbar spine, higher up. The symptoms vary according to the severity, and are usually disability, pain, and general nervousness. The disability consists of inability to lift, strain, sit, and, sometimes, to walk. The coccyx is tender to manipulation and to pressure and there may be a very marked hyperesthesia of the skin area directly over, and adjacent to, the coccyx itself. A common symptom is the tendency to sit on first one buttock and then the opposite, and oftentimes, in severe cases, the tendency to use the hands to lift the body after sitting.

The anatomy of the coccyx is of importance because of its function as the nerve supply and the influence of derangement upon the adjacent structures. The coccyx represents the remains of the anthropoid tail, for which reason it is often referred to as the tail bone. In the human being, the function is to afford attachments to muscles as a protection to the lower portion of the rectum. There are four segments to the coccyx which are, in the upper portion, practically vertebrae. These segments are joined together in a comb-like structure by capsule and ligaments, articulating above with the sacrum. The first segment is larger than the rest; it has an oval, hollow facet on its upper surface which articulates with the body of the last sacral segment, and shows two processes which lie in series with the articular processes of the sacrum, and they extend upward, uniting with the sacral cornua and bridging over the notch for the exit of the fifth sacral nerve, thus forming a foramen. From the outer sides project rudimentary processes. The second coccygeal vertebra displays slight traces of a transverse process and the rudimentary pedicles. The remaining segments are smaller and are more rounded, or oval shaped nodules of bone. There are four important muscle attachments to the coccyx: the gluteus and the coccygeus, anteriorly; the sphincter ani attached to the tip in front; and the levator ani to the tip behind. The nerve supply of this region is derived from the posterior divisions of the coccygeal and the second, third, fourth and fifth sacral nerves, and the anterior divisions of the five sacral and coccygeal nerves. This highly organized nerve supply, with its end organ beginnings, with peripheral protoplasmic receptive sensory function, is a peripheral dendrite of the cells in the posterior spinal cord ganglion.

As to the pathology, we may have actual sacro-coccygeal synovitis, adhesions, and fibrous thickenings, and an associated neuritis of the nerve supply, as manifested by the pain and other neurotic manifestations. The injuries are usually classified as bruises, dislocations, and fractures, and, where such injury occurs, there may be produced a periostitis, and the symptoms may develop with associated subcutaneous hemorrhage, accompanied by inflammatory process in the muscles inserted at the coccyx, or in the surrounding soft part or bones. The suffering may become very extreme from even minor injury.

The subjective symptoms which predominate are paroxysmal neurologic pain, which is described by the patient as a deep-seated, pulling, stabbing, burning sensation, or tingling about the rectum or sacral region. The pain may come on spontaneously, or while sitting down or walking, or when evacuation of the rectum takes place. The patient may also manifest a severe degree of neurosis and the interpretation of pain may be so severe that there is a complete exhaustion of the patient's nervous vitality. The paroxysms of pain are caused by movement of the muscles of the pelvic floor acting upon their nerve filaments. Local palpation may suggest the abnormality of position and the bone may be found deviated laterally or bent forward with angulation, or a very definite kyphos, and may be so firmly fixed by adhesions that no movement whatever is possible without pain. Often the tip of the coccyx feels thickened and is extremely hypersensitive. In fractures, which are not uncommon, hypermobility may be noted, associated with pain on movement, and crepitation in some cases may be elicited.

There are several varieties of displacement, but the forward position is, by far, the most common, the coccyx either remaining in its correct plane, or else becoming abnormally tilted, nearly always in the forward direction. Backward displacements are rare, but when they do occur, they may usually be associated with tilting forward. These two varieties of displacements could be characterized as a kyphosis and lordosis, respectively, of the sacro-coccygeal region.

Rectal examination, if possible, is always a great help in determining more definitely the degree of displacement, tilting, and flexibility, but, in some individuals, especially the neurotic type of woman, such an examination cannot be made without resorting to anesthesia. In differential diagnosis of the pain in the region of the coccyx, other local conditions must be considered. This should include foreign bodies, fistula, fissure, proctitis, ulceration, and disturbance of the low lumbar and sacro-iliac areas; also local inflammatory diseases, such as osteomyelitis, or even tuberculosis, must be considered. Teratoma and abscess formations should also be borne in mind.

In so far as treatment is concerned, most authors mention many types of conservative procedures, among them bandaging, application of heat by compresses, galvanic currents with an electrode over the coccyx, counter irritants, ointments, and hot sitz baths. Most authors feel that after a sufficient trial of conservative treatment, if the pain persists or becomes greater in degree, that complete excision or removal of the coccyx is indicated. The coccyx can easily be removed but the sequelae are

Washington, District of Columbia.

often as severe as the original condition because of a residual scar, which is adherent to the nerve endings in the vicinity of the coccyx, and, in the neurotic patient, this condition alone may render the patient more disabled than before operation. In some cases, post-operative neurofibromata can be definitely diagnosed. Considering the unsatisfactory results of either form of treatment in a considerable portion of cases, it has been attempted to device some procedure which would relieve the patient's pain and restore the normal flexibility of the coccyx. By the use of gentle manipulative procedures, with the gloved finger in the rectum, some patients can get considerable relief from their pain and disability. Other patients, however, especially those suffering from a long-continued and difficult neurosis, are unable to allow these procedures to be done, especially when repetition is necessary. Therefore, by means of a caudal block, followed by manipulation, it has been possible to help a number of patients to get relief without excising the coccyx. The caudal block is done either under local or general anesthesia, as preferred by the patients. From twenty-five to fifty c.c. of one per cent novocain are introduced in the cauda equina by the use of a Labot syringe and needle. The technique of this procedure is simple and produces a temporary, and, in some cases, lasting anesthesia and relief from pain. The restoration of normal, or nearly normal, position of the damaged coccyx relieves the strain upon inflamed tissues, and the sensitive nerve endings, and the greater flexibility allows for more normal action of the attached muscles and ligaments. It is possible in manipulating the damaged coccyx to loosen up adhesions between the segments of the coccyx without damaging the structure and to approximate the normal position and correct either displacements or tilts in many cases. The result of anesthesia from the caudal block gives the patient a percentage of relief from the pain, allowing greater activity and function, and a helpful period of rest, enabling the nerve vitality of the patient to be greatly restored, and the patient is not left with a painful, sensitive, adherent scar.

Ten patients, to date, have been treated by this method. In every case, trauma was the exciting cause. In two cases, displacements occurred, and in the remaining eight, marked anterior tilts, with some rigidity of the coccyx, and the usual train of symptoms, both neurotic and local, were present. In most instances, the disability inconvenienced the patient in following normal every day activities, such as sitting, standing, and lying. All these patients reported a marked and satisfactory degree of improvement, with greater ease and activity, less disability, and a minimum of pain. Local tenderness was decreased in all cases to a marked degree and flexibility was also improved. Eight of the ten cases felt that they were entirely well, with the one exception of sitting evenly, that is, not shifting from side to side to relieve symptoms. The period of time during which they could sit without discomfort was greatly increased and their general nervousness was very much less in every case.

It is my feeling that the patient who has had a painful coccyx removed and who still suffers as much, if not more pain, is one of our most distressing types of patient, which leads me to feel that excision of the coccyx should never be done in a pronounced case of neurosis or hysteria, unless a fracture dislocation is present; that most of the injuries to the coccyx, with the exception of fracture, can be successfully treated by the combination of nerve block and manipulative procedures to restore flexibility.

Pyretotherapy

William M. Schwarz, R. N., P. T.

The purpose of this article is to familiarize those persons interested in the production of hyperpyrexia, specifically that produced by diathermy, with a system of packing or wrapping that will give maximum heat retention and safety to the patient. Some of the readers may think the following method a bit radical or hard on the patient but one must remember that during high temperatures no matter how produced, the patient is exceedingly restless and many times delirious. Also many of the patients are psychotic, and reason and cooperation on their part can not be expected. I shall also give a brief resume of the technique used and the care of the patient during the treatment.

Most physicians recommend thirty hours of fever, that is, thirty hours with the temperature between 103 and 106. Temperatures above 106 are dangerous and patients should be carefully watched so that they will not exceed that point. The minimum number of hours may be reached by administering ten treatments, maintaining the "fever" for three hours each treatment. This method is comparatively easy on the patient and he may be given a fever on alternate days without much loss in weight. During the treatment he may lose as much as five or six pounds but this is regained in a few hours after treatment, most of the loss is only loss of water.

The articles necessary for the pack are listed below:

Twelve strong blankets.
Eight full size bed sheets.
Six hand towels.
Three bath towels.
Three pillow cases.
One spread (to cover the patient while treatment is going on).
One full size rubber sheet.
Two rubber draw sheets.
One fracture board.
Six pack pins.
Enough cellucotton or other highly absorbent material to envelop the buttock, abdomen and chest.

After protecting the mattress against soiling in case

Pennsylvania Chapter, American Physiotherapy Association.
Illustrated by Charles Stepule, Jr.

the patient regurgitates, lay the blankets, etc., as follows:

Place four blankets lengthwise across the bed so that their upper edge is nine inches from the head of the bed. On top of these and even with them place the full size rubber sheet; next, four more blankets in the same manner as the first four; next, the sheets, four to be used and placed lengthwise across the bed eleven inches from the head of the bed. (See Figure No. 1.) Each leg and thigh is wrapped separately in order to prevent heat loss when the temperature is taken by rectum. Mouth temperatures are unreliable in most types of cases treated; not only because of the mental condition of the patients and the danger of their breaking the thermometer in their mouth, but also because of the increased ventilation of that part of the anatomy during fever. To wrap the lower extremity, place an open blanket so that the top edge will come up to the buttock, not under it. Have it at such an angle that the leg will be perpendicular to the top edge when the legs are spread wide. On top of this and even with the top edge place another blanket folded in quarters. The rubber sheet comes next which is also even with the top edge. Now, one sheet, which has been folded lengthwise, is placed with one end even with the buttock end of the blankets and rubber sheet, and the other end left hanging over the foot of the bed. (See Figure No. II.) The procedure for the other leg is the same.

The cellucotton is next placed about twelve inches from the top of the sheets with equal quantities on each side of the bed. The purpose of this material is to absorb as much of the body discharge as possible. By keeping the skin free from large quantities of perspiration the possibility of the current running around the body instead of going through it, is reduced to a minimum. The width of the cellucotton, about twenty-four inches, will be sufficient to cover from buttock to axilla. The length depends on the girth of the individual to be treated. Some of the cotton may be removed from the axillary region after the patient has been placed on the bed. This will increase the comfort of the patient and minimize the possibility of cutting off the circulation of the arm, forearm and hand.

The electrode jacket is now placed on top of the absorbent material in the approximate position. The posterior electrode may now be placed atop the jacket so that it will be completely covered when the electrode and jacket are fitted to the patient. The electrodes may be heated with infra-red or any other form of dry heat before they are applied to the skin. This is for comfort to the patient only and has no therapeutic value.

The patient may now get on the bed so that his head rests on the top edge of the pack. This position will bring the rest of the parts of the pack in their proper location in relation to the patient. The lower edge of the posterior electrode should not extend beyond the fourth lumbar vertebra. This is to eliminate heat concentration in bony areas where possible. Press the electrode well to the surface of the skin making the metal take the shape of the back. The anterior plates are applied while the patient is lying down. These, too, shall be molded to fit the contours of the chest and abdomen. Great care must be taken with this step in the treatment because a poorly fitted electrode may mean a severe burn, the prevention of which is always wiser than the cure. Electrode jellies and soap suds are not necessary because as soon as the patient starts to perspire he makes his own perfect contact, perspiration being a good conductor. The jacket is now laced about the patient as snugly as he can stand with ease. The shoulder straps are tied with a wad of soft material under them to relieve possible cutting should the patient toss or twist about.

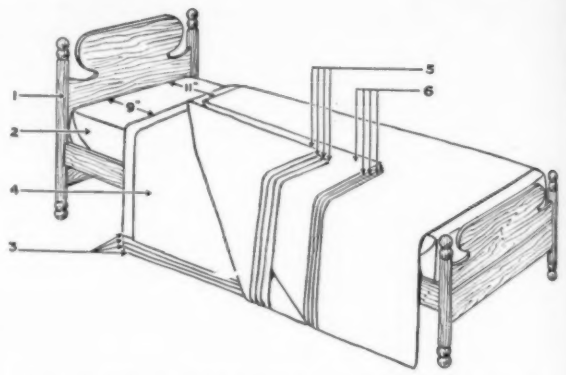


Fig. 1. 1, Bed. 2, Blanket covering mattress. 3, Four blankets. 4, Rubber sheet. 5, Four blankets. 6, Four sheets. 9 inches from head of bed to blankets. 11 inches from head of bed to sheets.

At this point the electrode cords must be taken care of. The posterior cord and the chest cord are placed next to the neck on the side nearest the diathermy machine. One side of the absorbent material is wrapped about the patient's body. The cord from the abdominal plate is carried up over this to the neck where the other two cords are already placed. Connect the two anterior plate cords with the two-way plug so there will be no mistake later. Should the anterior chest plate cord be combined with the posterior plate cord and the current be applied with this hook-up, the abdominal plate alone would be acting as the active electrode and the current concentration in that region would be so great as to cause serious damage. The other side of the absorbent material is put over the patient thus enclosing the cord from the abdominal electrode as it passes over. At this point the pre-operative temperature and blood pressure may be taken if it has not been taken before.

We are ready to apply the sheets, etc. The lower extremities are wrapped one at a time. The sheet is folded back to the groin and the two sides folded over the top. The rubber sheet is turned back over the foot and the sides are wrapped about, forming a boot. The blanket folded in quarters is folded about the extremity so there will be four thicknesses on all sides and at the foot end. The open blanket is wrapped about so as to hold the other blankets snug about the limb. Both limbs are prepared in this manner and then moved close together. The rest of the body may be wrapped now in the following manner: With the arm over the head the first sheet is pulled down at an angle so that it will come just below the axilla. From this point it is pulled tightly over the patient's chest and abdomen and tucked in on the opposite side of the body. The other side is prepared in the same way. This will keep the patient from picking at the absorbent material, keep him from getting directly at the electrodes and causing them to be displaced, and makes for comfort since some types of absorbent material, such as cellucotton, may irritate a tender skin.

The next sheets are folded down over the shoulder one at a time, and anchored under the opposite shoulder in the same manner in which the wet pack is applied. The rubber sheet and the blankets are applied in the same manner and fastened with pack pins. The entire pack may be covered with a spread or sheet. A linen towel should be placed as a collar about the patient's neck to relieve the itching of the woolen blankets. This is changed

frequently during the treatment for a dry one. An ordinary pillow, protected with a rubber pillow case, is used to support the head, and a rolled blanket or a leg roll may be used to support the knees.

Restraint sheets may be used over the knees and chest as the situation arises. However I suggest restraint be lightly applied in all cases so that it may be tightened when necessary. During the height of the temperature the most cooperative patient may become very restless and if not restrained from tossing about may dislodge the electrodes; the result would be a burn.

By incorporating the fracture board in the pack, that is, between the last blanket to be applied and the rest of the pack, the most active patient may be treated with ease and safety. A small rubber sponge pad may be placed on top of the board to increase the comfort to the patient. This board should not exceed the shoulders as the patient might strike his head in his restlessness while the pillow is removed to change the wet cover for a dry one. The two ends of the blanket are pulled up tightly over the entire pack and secured with three or more pack pins. A sheet may be rolled corner to corner and passed under the entire pack, brought up and tied just above the knees. This will not interfere with the taking of the rectal temperature.

The ideal support for this type of wrapping is the pack table. It is high enough to make necessary adjustments and care easy and without strain on the operator, and it provides proper anchors for the restraints. Any bed or cot large enough may be used. When treating on the regular hospital bed with the regular spring I suggest the use of the fracture board between the mattress and the spring. If necessary the rails of the bed may be used as restraint anchors. Many cases will not need restraint or sedative, others will need both.

For a sedative we have had best results with sodium luminal grs. 2 by hypodermic injection. One injection at the start of the treatment and another about in the middle will usually be all that is necessary. Sodium amytal in three grain doses has proven successful in some cases. In some of the most apprehensive cases morphine sulphate has been used to the best advantage. If sodium amytal is used it must be remembered that it acts as a stimulant to some people. This activity to drug stimulation may be mistaken for restlessness which would invoke another dose of the sedative and make the restlessness worse. I recall one case to which we had given sodium amytal grs. 3. He was noisy and restless so the drug was administered again. His restless attitude and shouting continued through the treatment and lasted well into the night. At the next treatment he was given sodium luminal grs. 2. During the entire treatment which lasted above five hours he was cooperative and quiet. Later in the course of treatments he was treated with no medication and cooperated throughout.

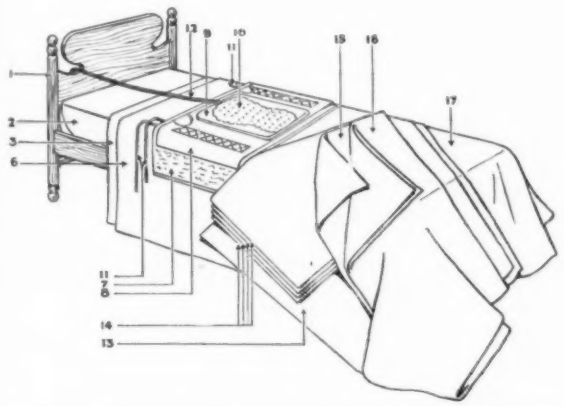


Fig. 2. 1, Bed. 2, Blanket. 3, Blankets (See Fig. 1). 6, Sheets (See Fig. 1). 7, Cellucotton. 8, Canvas jacket. 9, Sponge rubber mat. 10, Plate. 11, String of jacket. 12, Cord coonnecting plate. 13, Blanket open. 14, Blanket folded twice. 15, Rubber sheet. 16, Linen sheet folded twice. 17, Same as 13, 14, 15, 16 but on other side of bed

The high frequency machine is started and 2200 to 2800 ma. are allowed to pass through the patient. After about fifteen or thirty minutes the patient will begin to perspire. This perspiration will indicate to the operator that the body has begun to react to the passage of the high frequency current. The sweating is the body's attempt to keep cool. Now that the sweat glands are functioning and the skin resistance overcome, the maximum ma. that the plates will carry may be used. This maximum point should be reached gradually over a period of about thirty minutes. It has been my practice to increase the current to 3100 to 3700 ma. at this point in the treatment and holding it there until the desired height in temperature has been reached. I have found a temperature of 105 can be reached in three hours with the maximum ma. reading of 2800 when the before mentioned type of wrapping is used.

For the first hour there is little change in the temperature. The pulse will increase rapidly while the respirations remain about the same throughout the treatment. After the first hour the temperature begins to rise by two-tenths of a degree for fifteen minutes. The next fifteen minutes shows four-tenths of a degree rise, then six-tenths and so on till one degree every fifteen minutes is seen. The pulse rate increases with the temperature and frequently reaches 140 or more. No ill effects have been noted during such an increase in heart rate. After the temperature has reached the desired height the machine is turned off and the patient uncovered. The temperature will drop at once, in some cases it will return to normal in less than one hour. If the sustained fever is desired the machine may be turned off when the temperature reaches 104. It will continue to rise and because of this the patient's temperature should be checked every five minutes. On no occasion should the temperature be allowed to exceed 107. Should it get threateningly close remove the pack down to and including the rubber sheets. Should this not produce the desired fall in temperature remove the entire wrapping. If this treatment fails give cold sponges, cold enema and cold drinks. By removing part of the wrapping and giving cold drinks the temperature can be maintained at almost any level with one application of current. I have produced sustained fever lasting three hours with one application of current. The machine was turned off when the temperature reached 103.2. The temperature rose to 104.8 and remained at that point for one hour and a half. It then began to drop two-tenths of a degree at every fifteen minute reading. At this point the three hour period was ended and the patient uncovered. It is my belief that the temperature can be maintained for almost any length of time if the proper insulation and heat retention methods are used.

It is noted that the pulse rate drops when the current is turned off. A drop of as much as sixty beats per minute has been noted while the temperature continued to climb. This drop did not hold till the end of the treatment; it rose to 120 and remained until the patient left the treatment room.

To continue the report of the case noted before, the

temperature was above 103 for three hours. During that time it did not exceed 105.4. The patient was comfortable and rational throughout. After the temperature had returned to normal the patient was able and willing to walk to his room. He should rest for the remainder of the day and the temperature should be checked every four hours. The patient will usually go to sleep after the treatment and many times he will sleep at the beginning of the treatment before the temperature has begun to rise.

There are great quantities of liquid lost during the fever and much discomfort is experienced on this score. Thirst, while the temperature is rising, may be quenched by hot tea with lemon. Cold drinks at this point would impair progress. After the temperature has reached 104, cold drinks in small quantities have little effect on the gross temperature of the patient. Fruit juices, water or tea are best suited for this purpose. Milk drinks are not handled well by patients while in the course of hyperpyrexia. Cracked ice will aid the apprehensive patient as he may chew it and thus have something to do. In sustained fever the radio may be used to help entertain the patient after the high frequency machine has been shut off. Regurgitation is common if large quantities of liquids are given. Apprehensive patients may regurgitate with no apparent reason.

In this short article I have attempted to set forth a method by which patients who are apt to benefit by hyperpyrexia, no matter how psychotic or hyperactive, may be prepared so that treatment may be administered with safety and ease. I also included a brief explanation of the way treatment is given. Above these, one must have a good working knowledge of the cardinal symptoms, for it is by these that the operator knows the condition of the patient being treated. And above all these, common sense must be exercised to the utmost.

The Rational Organization of a Hospital Physical Therapy Department

H. M. F. Behneman, M. D.

In this present era of specialization in medicine with the increasing cost of hospital maintenance and high cost of medical care, every effort must be made to cut down the number of sick days per capita. This is especially true in industrial medicine, where the economic loss is often far in excess of the cost of care. The earlier a patient resumes his work or his place in the community, the greater the economic gain for all concerned—the patient, the employer, the insurance company and all dependents.

As one of the means toward this end, a well-planned and well-conducted hospital department of physical therapy has now become recognized as a necessity. Physical therapy is no cure-all, neither is it a specialty in itself, but it is an invaluable adjunct to many phases of the practice of medicine. Moreover, there is absolutely no reason why the hospital department of physical therapy should not produce a large and constant source of revenue—at least be self-maintaining. Its construction and maintenance depend upon various factors to be discussed later, but in its planning one must keep constantly in mind that its success depends, not upon floor space and equipment alone, but primarily upon the personnel; first, in their knowledge of the subject and secondly, the cooperation they manifest to other departments. Two of the most important therapeutic procedures in physical medicine are massage and exercise, and only thoroughly trained individuals can do this work properly. Of what use is the finest equipment without accurate knowledge of the physics or physiology underlying its rational use?

The physician often has to depend upon the community hospital for aid in giving his patients the most modern and rational medical care. It becomes the obligation of the modern hospital both large and small to provide the latest advances in a rapidly progressing field of science. The average physician cannot hope to afford all the equipment that modern medicine demands; so he turns to the hospital. Moreover, as we rapidly advance in medical science, it is often the intelligent patient who demands modernization in therapy. It is a strange and unfortunate fact that physical medicine, the oldest form of therapy known to man, should have finally emerged into the limelight of real utility in such disparaging style and company. However, the war greatly emphasized the possibilities lying in this field of medicine. Since the time of Hippocrates and the temple of Ausculapius, heat, water, light, massage and exercise have been indispensable allies in the age-old battle with illness, and the last few years have seen its renaissance. Because physical therapy is useful, and old, and worthy of infinite consideration, it is going to become of increasing importance in medical practice.

Therefore, any article such as this, written upon a subject that is progressing with such rapidity, must necessarily confine itself largely to generalities. What is ideal equipment today, may be far surpassed by new things within a year, even though the fundamental principles underlying its rational use may remain the same. In the assembling of a hospital department of physical therapy we must include the following measures at our disposal: actino-therapy, hydrotherapy, thermotherapy, mechano-therapy, electrotherapy, radium therapy, roentgen therapy, occupational therapy, massage and exercise.

With this fact in mind, the organizers and supporters of a hospital physical therapy department can turn to any of the following agencies for sound and logical advice: (1) The Council on Physical Therapy of the American Medical Association, (2) The American Hospital Association, (3) The American Congress of Physical Therapy, and (4) The American Physiotherapy Association. The first body is to physical medicine what the Council on Pharmacy and Chemistry is to the realm of drugs and chemicals. They may be consulted about the construction, the safety, the physics, the use or the

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soundness of apparatus; the second agency is able to give sound advice upon the desirability and placing of equipment; and the third and fourth societies can give very useful information concerning personnel, handling of patients and the bibliography of the subject.

In consideration of this important medical and economic problem it is necessary to consider the five factors enumerated as follows: the hospital desiring a department of physical medicine, the community supporting it, the department itself, the patient and the treatment. Let us consider the first item:

I—The hospital.
1. Type.
   (a) General.
   (b) Industrial.
   (c) Private.
   (d) Special.
2. Number of beds.
3. Average number of patients, daily (bed or clinic).
4. Average number of patients, new (bed or clinic).
5. Average number of daily treatments.
6. Space provided.
   (a) Area.
   (b) Location.
   (c) Construction.
      1. Water supply.
      2. Plumbing.
      3. Electric current and type needed.
      4. Wiring.
7. Is it a separate department?
8. Finances of the department.
   (a) Money available at outset.
   (b) Is department to support itself?
   (c) What is charged the patient?
9. Is there an outpatient department or clinic?
   (a) Is it a separate building, or part?
10. Is it a teaching institution?
   (a) Technicians.
   (b) Medical students.
   (c) Nurses.
11. Is there need for occupational therapy?
12. Are records kept?
   (a) Type and by whom?

II.—The community.
1. Residence.
2. Industrial.
   (a) Kind.
3. Racial problem.
4. Percentage of children.
5. Geography.
6. Climate.
7. Financial status.
8. Value to the community.
9. Type of disability most prevalent.

III—The department of physical therapy.
1. The personnel.
   (a) Is there a medical director and is he connected with other departments?
      1. What department?
      2. Full time or part
      3. Does he direct or also work with technicians?
      4. What is his salary and how is it determined?
         (a) Percentage of income?
         (b) Flat salary?
   (b) The technicians (resident, part time or on call?)
      1. Number.
      2. Training.
      3. Any student help?
      4. Any nursing help?
   (c) Relation to doctors.
      1. Do doctors write their own treatment instructions or rely on department head?
      2. Do they consult frequently with their department head?
   (d) Number of patients treated per day.
   (e) Salaries.
2. Subdivisions.
   (a) Exercise, gymnastics and posture.
   (b) Massage.
   (c) Hydrotherapy.
      1. Tank size, indoors or out.
      2. Availability to entrance for bed patients.
   (d) Electrotherapy.
      1. Heat.
      2. Chemical.
      3. Mechanical.
   (e) Actinotherapy.
   (f) Occupational therapy.
3. The equipment.
   (a) The amount of money available at outset.
   (b) Does future purchase depend on income?
   (c) Minimum required at start.
   (d) Kind required in relation to type of patient.
   (e) Estimated cost.
   (f) Will it be suited and useful to the building and its condition?
   (g) Approved by Council of American Medical Association.
   (h) Company purchased from.
4. The records.
   (a) Standard form?
   (b) Filing methods.
   (c) Their importance.
5. Working hours and conditions.
   (a) Day or night?
   (b) Number of hours per day.
   (c) Actual environment and work place.

IV—The patients.
1. Private, part-pay or free.
2. Their transportation for treatment.
3. Are they bedridden or ambulatory?
4. Are they carefully examined and proper therapy indicated?
5. How many can be properly treated per day?

V—The Treatment.
1. The time it takes.
2. The kind predominating.
3. The frequency of visits.
4. Division of certain types into specified days.
   (a) Medical gymnastics.
   (b) Hydrotherapy: (tank).
5. Separation of sexes or races.
6. Does it need medical supervision or consultation?
7. Does the director prescribe the treatment or does the doctor who refers the case?

XUM

THE HOSPITAL

At the outset, the type of hospital is of utmost importance in planning a physical therapy department. If it is a general hospital, there are all kinds of disabilities to be treated, the turn-over is great, more help and equipment are necessary. If it be an industrial hospital, usually one or two well-defined groups of disability take the lead. Therefore, special equipment or certain apparatus must predominate to the slight use or exclusion of others. In a privately owned small hospital where low expenditure and restricted overhead are necessary, there must be the most useful equipment with a well trained technician to make the best use of it. Special hospitals confine their admittances to certain groups of patients—obstetrical, pediatric, eye, etc., with the result that only certain forms of physical therapy are needed. It would be a waste of valuable space and money, for instance, to build a hydrotherapy tank in an eye hospital, just as it would be inexcusable not to have it in a children's hospital. Yet we often see a situation just as ludicrous. The number of beds in a hospital and the number of ambulatory patients is of utmost importance in estimating the average and maximum amount of work the physical therapist will have to accomplish. The hospital is concerned with this fact in the problem of income, and as to whether these beds are free, part-pay or private, with varying charges.

The organizer of a hospital physical therapy department is vitally interested at the outset in the number of patients; he needs to know whether they are ambulatory or not, whether treatment has to be given at the bedside, the expected number of new patients, the frequency of visits of old ones, their type of therapy and the time it takes. Too much stress, however, is placed on the space provided. While it is most desirable to have plenty of space, a tremendous amount of good can be done in a small department. No hospital should ever hesitate to install physical therapy upon the belief that one large area must be available first. In fact, at least seventy percent of the excellent work being done at the present time in this field, has been accomplished under crowded conditions, in anything but cheerful surroundings. A hospital that is already built should extend every effort to start a physical therapy department, even if it must be done in cramped quarters and with undesirable accommodations. By this means the importance of this subject is brought to the attention of the staff, which usually results in fairly prompt acquisition of both space and equipment.

In the planning of a new hospital, however, definite plans should be made for proper utilization of every square foot allotted to this department. Knowing the area, the next important question is its location in the hospital. Is it in the main building or is it apart? Is access to it easy from all other departments of the hospital? Can heavy equipment, such as diathermy, be moved to the beds where it may be needed? Of utmost importance is the early recognition of the fact that a tremendous amount of labor and expense will be saved if water and electricity is properly placed, with many wall plugs, good lighting, and proper plumbing installed for both present and later equipment. Whether or not the current is direct or alternating often determines both the equipment and position in a building.

I feel that the advance in work accomplished and the financial gain will be much greater if this department can be made a separate unit, with its own director and budget. Invariably, when it is under the wing of a separate department, there is a tendency by those not completely convinced of its value, to disregard its needs and retard its normal expansion. There is no reason why a subject of aid to nearly all the specialties of medicine should be under the control of some department head who is either averse to its development or over-zealous in feeling that only his department can properly use it. I make one exception here, and that is the fact that it seems plausible to eventually include physical therapy in most of its aspects in the department of roentgenology. The director of the department of radiology will undoubtedly, as time goes on, become the figure around which will revolve the steady advances to be made in the field of radiant energy. Already some medical schools and hospitals are following out this plan, and with logical success. Certainly, the roentgenologist is the one man on the staff with a fundamental knowledge of light, electricity, radiant energy, anatomy and physiology. If physical therapy is not a part of this department, then it should be entirely separate, directed by a qualified, interested man and conducted by a good technician.

In any hospital, no matter what its type, finances are of utmost importance, not just in initial output, but in the maintenance of the department. When money is scarce and the minimum equipment must be purchased for the average general hospital, it should be spent wisely for some apparatus that can be used in the greatest number of conditions. The air and water-cooled quartz light, the infra-red or luminous lamp, the whirlpool bath, the galvanic and sinusoidal machine and the standard size diathermy can be used to the greatest advantage and accomplish infinite good. The leading manufacturers of these machines are usually only too glad to cooperate in every way with the hospital in planning this department, both in the actual installation and in the financing of it. It should be an iron-bound rule that a definite sum be set aside for the salary of a well-trained staff, whether it be one or more. The finest equipment in the world is useless without one trained in its proper and rational use. In addition, it must be kept in mind that this person is going to do an equal amount of work without apparatus—in the field of massage, exercises, postural training, etc. The income from a physical therapy department depends entirely upon the type of patient handled and the efficiency of the therapy. In a clinic or community hospital supported by some state or county budget, there is usually no charge or a very minor one of fifty cents to a dollar a treatment. In part-pay hospitals the charge is two dollars, and in private hospitals charges range from four and five dollars to as much as ten dollars per treatment. It can easily be seen that where even a moderate charge is made, the physical therapy department should be a source of revenue to its hospital, and it should be able to expand continuously. In a medical school, where little or no charge is made the patient, the department must exist wholly or partially upon an annual budget, which is unsatisfactory from the standpoint of development, especially in the opportunity of carrying on research with other departments.

Many medical schools and large hospitals of all types have a separate building or clinic for ambulatory patients, which necessitates two departments of physical therapy. This is unfortunate both in loss of time and expense, and should not be tolerated in the construction of a new hospital or department.

A large factor in the work accomplished and in the finances of a physical therapy department, is the question of help. As soon as a department, at the discretion of its director, becomes large enough and successful in

its work, the staff should start training technicians. This causes some increase in overhead, but it is usually offset by the tremendous amount of help contributed by these students. They usually pay for the course, and are soon able to relieve the small full-time staff of a good deal of work. A good course should run at least nine months, with training in the fundamental sciences of anatomy, physiology and physics, underlying the proper use of all physical therapy procedures. It is desirable to have previous training in nursing or physical education. In medical schools there usually are groups of medical students assigned in rotation to the physical therapy department. They are there however for instruction and cannot be considered as actual help to the execution of its daily routine. Nurses, however, should be given at least a month in this department. Naturally it does not train them to be technicians, but it gives them an understanding of the rational use and efficacy of physical therapy.

The world war brought out the tremendous value of occupational therapy. It is in reality just physical therapy in a form attractive to the patient, enabling him to see the results of his exercise in an encouraging and satisfactory manner. This is one of the most neglected and yet the most important parts of this field of treatment. There is no reason why, within a reasonable time, it cannot be self-supporting, as there is always an outlet for the materials made through various agencies, particularly women's clubs. Occupational therapy should be planned upon from the start in the organization of a physical therapy department.

Records, which for a variety of reasons—medical, legal, and otherwise—should be carefully kept. I feel adequate provision for good records should be made. Upon the evidence accumulated from them, rests the one accurate estimation of the efficacy of the department. No standard record form is given here because hospitals already established have their own forms, and new hospitals can draw theirs to suit the need of the times. Records, naturally, should contain complete information about the patient, as in every other hospital department; the entire history and diagnosis, previous procedures, etc. In addition, this department should have space on the record blank for the kind and frequency of treatment, daily notes on progress, the charge if any, etc. In other words, it is of great importance to have a brief printed form, easy to keep, and easy to analyze when there is need for the compilation of important data for study or publication. Records in physical therapy have been sadly neglected, for which there is little excuse.

So much for discussion of the hospital itself: it can readily be seen that the scientific and financial success of a hospital physical therapy department depends a great deal upon preliminary thought of these and other factors.

THE COMMUNITY

The community demands service rightfully from its hospitals. It demands either through its medical men or through its well-informed laity the most modern advances in medical science. Therefore, the group responsible for the erection and equipment of a hospital must necessarily pay strict attention to the needs of the community. If it is chiefly a residence community, its disabilities will be varied and a general hospital will most likely result, as well as the need for equipment destined to care for many types of cases. If the community be industrial, the physical therapist will find his work often confined to certain phases. He may find he devotes more time to post-surgical treatment, to fracture healing, to burns, to respiratory infections, etc. This can all be worked out in advance, and logical use made of this information in the equipment of the department. Here local, county and state morbidity statistics are also valuable. If there are white people mixed with blacks, the problem of segregation appears. If there are many children, the needs in this department are going to center toward a hydrotherapy tank, toward ultra-violet therapy, posture training, occupational therapy. The geography of the surrounding country plays a role, because we know in certain sections of this country certain diseases predominate and prevention becomes a most important duty, such as the daily or weekly exposure of school children to ultra-violet radiation which now is taking place in many sun-starved American cities during the winter months. Climate runs hand in hand with geography. There is an old Italian proverb to the effect that "Where sun does not enter, illness exists." The financial status of the community is important to those planning a hospital department of physical therapy, because upon the residents depends the maintenance of the department, and just allowance must be made.

This is certainly no place to argue about the great economic value of physical therapy to the community; it is one of our greatest aids in both the prevention and treatment of disease and injury. This subject is now riding on the crest of a wave of well-deserved recognition and is advancing with rapid strides everywhere. Only its inherent usefulness saved its early death in the hands of the charlatans and non-medical parasites who have so long exploited it to the laity.

THE PHYSICAL THERAPY DEPARTMENT

In consideration of the department itself, the personnel is most important. The ideal situation is to have a full time physical therapist who is a physician, trained in the subject. If this is not possible, the part time medical director should have a well trained technician. Her duties should be the execution of his orders. She should never prescribe treatment, but should keep careful records of her work at all times. The American Physiotherapy Association feels that the average technician cannot handle, alone, over twenty patients a day. If she has help this can be doubled. The director should do his utmost to acquaint all referring physicians with the physical therapy department. He should request them to prescribe the treatment or freely offer his cooperation in advising the type of treatment. For its own protection, aside from other logical reasons, the hospital should never allow the technician to prescribe therapy, any more than a nurse should write a prescription for drugs. The referring physician should be careful to make as accurate a diagnosis as possible. Ths director's compensation depends on several factors. An equitable system is to pay him fifty percent of the net income of the department. This encourages him to strive for a lower overhead and stimulates him to thorough accomplishment.

The average good technician receives $125.00 to $175.00 a month in western hospitals. There are usually one or more applicants for training, so that the director and technician should work toward the establishment of a definite nine to twelve months course for student technicians, especially when the hospital is in a lay medical center. The technician should never give a treatment unless prescribed by a physician. Such a rule avoids many unpleasant experiences and situations. The proper training of technicians adds greatly to the daily capacity of patients, as by degrees the students can take over certain work. Nurses and medical students are usually not in the department long enough on their rotating service

to accomplish much. I cannot overstress the necessity of a well-trained and balanced technician. Upon her work a department succeeds or fails.

In considering the actual planning of the floor space and construction, one must consider the facts previously discussed. The department should be convenient to all other departments of the hospital, reached easily by doctors and patients, whether ambulatory or not. Privacy is desirable and toilet facilities are necessary for both sexes. At least all the electrotherapy and light therapy should be in one unit. Gymnastic apparatus including exercise, massage and postural training can be together. Hydrotherapy often needs to be on the lower floor because of the weight of the tank and other plumbing problems. The author feels that small booths are necessary for treatment rooms, with a seven foot wall, except on one side where curtains may be used (sheets). The plans for equipment installation in a hospital starting construction, should be finished early so that the wiring and plumbing may be taken care of properly. One cannot give the absolute number of square feet needed per patient or per treatment. The type of patients, the number of technicians and many other factors enter into this. The American Hospital Association is glad to advise upon this problem when requested to. Actual floor plans for three hundred and fifty, two hundred, one hundred and twenty-five bed hospital physical therapy departments are presented in the minutes of the Annual Congress on Medical Education, Medical Licensure and Hospitals, American Medical Association, February 18, 1930, in a paper by William H. Walsh. This is obtainable upon request from the American Medical Association.

An important part of a large hospital is the department of occupational therapy; it is definitely therapy in the form of a workshop. It speeds up recovery, it has a big psychic value and it is always a good means of contact between the social workers, the women's clubs and various sources of financial aid.

The equipment of a hospital, naturally depends on most of the above factors. Eighty-five per cent of all hospitals in the United States are small general hospitals. The physical therapy department to be of greatest use should have one or more of the following types of apparatus, dependent upon finances, the number and type of patients and the work accomplished:

Diathermy, medical and surgical.
Ultra-violet quartz light, air and water cooled.
Sine machine.
Galvanism.
Infra-red or luminous heat lamps.
Electric bakers.
Gymnastic apparatus: Including muscle training table, rowing machine, parallel bars, rings, head sling, basket ball, stall bars, pulley and weights, Kanavel table, etc.
Hydrotherapy:
1. Whirlpool baths, arm and leg.
2. Shower (needle).
3. Tank (small or large) with overhead block and tackle; walls should be about four feet high with a step 18 inches wide and 18 inches high.
4. Heater for hot wet packs.

Massage tables: Full length treatment tables, thirty inches wide, thirty-five inches high with a shelf underneath about eighteen inches from the floor.
Dressing rooms.
And finally a radiotherm, inductotherm or equivalent apparatus for the producing of artificial fever, a local heat therapy.

It costs a good deal to maintain some electro-surgical apparatus if they are not used by one familiar with their construction, as well as their indications. In general, it should be said that equipment should be purchased only when the demand for it is sufficient to warrant its purchase.

A busy department that charges patients moderate fees will have a good income. New apparatus can be bought as time goes on. It is important to remember that types of apparatus change rapidly. What appears very efficient at this writing may be inefficient in a few years. An ideal department now will not be equipped exactly the same ten years from now. Equipment will depend chiefly on the type of disability treated. One must bear in mind that type of electrical current and possible load when arranging as well as purchasing the equipment. Be sure that the equipment is of proven value and accepted by the Council on Physical Therapy of the American Medical Association. Quiet is always desirable, so that the use of resilient flooring is preferable, such as battleship linoleum. Rubber mats as insulators are necessary adjacent to all electric machines. Lighting should be indirect. The wiring should result in a double outlet with plates and plugs designed differently. On each floor of the hospital should be a double outlet in case patients must be treated in their rooms.

Scientific attainment is in a large measure controlled by careful and accurate records. Fair evaluation of the efficacy of physical measures can be judged only by well kept records. An ideal system is the establishment of a standardized form, fitting into the general records of the hospital. The clinical charge should accompany the patient to the treatment room where a note should be made. There should be a card index system with diagnosis on one side and name of the patient on the other. The department should keep a daily record book for its own files and information. A well trained director should always maintain careful checks on all work performed.

The average working day for a physical therapy technician is seven to eight hours. Work should be evenly distributed over the whole day and not crowded into the morning. As in other fields of endeavor, there should be ideal working conditions with plenty of fresh air, sunlight if possible or good electric light. Walls and woodwork should be white or green and cheerful. Patients will react better and the staff will work better.

The treatment itself should be planned by definite appointments with the patients. By careful allocation of certain types of patients or disabilities to certain periods of time, much can be gained in speed, in the number of treatments and in generally better execution of duties. Rather than decrease the number of visits of an old case, the physical therapy technician should refuse new ones if she is crowded for time and lacks help. Frequency of treatment is often a big factor and recovery and convalescence should not be delayed because of new cases breaking into the schedule, unless they be emergency. Some treatments can be given in groups or classes, such as posture and medical gymnastics. In some hospitals racial differences necessitate either duplication of equipment or allotment of certain days to certain groups. The presence and help of the director is necessary and certain definite hours should be spent by him in the department so that other members of the staff as well as his technician can depend upon his presence for consultation and discussion. In his absence technicians should not prescribe treatment.

I am sorry I cannot be more specific in my state-

ments but as you can see, each hospital presents its own problem.

However, there is an aspect of this whole problem which cannot be ignored. Some of you may still wonder why you should have a department. I fully realize physical therapy is in ill repute with many medical men and numerous insurance companies. Why should this age-old form of therapy be looked upon by so many as the parasite infested illegitimate child of medicine, when in reality it is the parent? I feel that the causes are primarily these:

1. Its use and abuse by thousands of quacks and charlatans.

2. Its failure to accomplish results, in innumerable cases due to faulty diagnosis, improper direction for treatment, forced upon a patient in whom it is contra-indicated, treatment over-done or insufficient, absolutely faulty management and gross ignorance of the technician.

3. The unfair practice of sending to physical therapy chronic patients, just because they fail to progress in every other department of medicine.

4. The mistake of looking upon physical therapy as a cure-all. It is not. It is merely an adjunct to other methods of therapy.

5. The inexcusable practice indulged in by members of our profession of having a physical therapy technician in their office purely as a means of financial gain —sort of a steady income to pay some overhead.

6. The rank dishonesty of innumerable salesmen representing equally questionable firms, making preposterous claims, inveigling thousands of doctors into purchase of worthless apparatus, giving lecture courses which are nothing but high pressure selling methods, and last but not least, charging an enormous price for some nice, shiny, space-consuming trash.

7. The unfortunate fact that the most ignorant layman can buy from almost every dealer any piece of physical therapy apparatus, some of them capable of producing injury, disease and even death.

8. The still more unfortunate fact that there is no law in this state prohibiting any individual from masquerading as a physical therapist and blatantly announcing it in various manners.

9. The undeniable fact that many insurance companies have unduly paid out a great deal of money for physical therapy without results—either because of its plain contraindication or uselessness, and improper and prolonged treatment of the patient.

10. Our own procrastination in its acceptance and our own laxity in not being as sure of the physical therapists' knowledge whom we refer patients to, as we are meticulously careful of our other specialists.

These and other factors have given you just cause for doubt and discouragement.

There are solutions for these unpleasant truths, but time does not allow further discussion here. I mention them thinking you may have hesitated in the development of your department because of lack of faith in the subject. I am firmly convinced that therapy in medicine is turning a great deal from chemotherapy to radiant energy. Physical medicine is becoming of increasing importance.

The ethics of medicine does not permit us to become soap box orators in a fiery crusade against the quack. But after all we can more permanently annihilate him by accepting rational physical therapy ourselves, and giving it to our patients when indicated. The chief item in such a program is the establishment and support of a hospital department where you and I may send out patients knowing they are receiving what they need in the manner in which they may derive benefit.

NOTE—Upon request, Dr. Behneman will be glad to furnish a long bibliography. 384 Post St., San Francisco, Calif.

The Program of Wisconsin's Crippled Children Division

Marguerite Lison Ingram

Ten years ago the facilities in Wisconsin for the care of crippled children, were limited to an inadequate number of hospital beds for the care of orthopedic patients, and a custodial home for dependent and neglected children. Crippled children committed to this latter institution were sent to the State Hospital for any necessary surgical care.

Because of the inadequacy of these facilities to cope with the crippled child problem, a definite program was instituted to enlist public interest in the formulation of a more comprehensive state-wide program to insure not only sufficient hospital facilities but also to provide facilities for after-care and education.

Preliminary to any statement of needs or formulation of tentative plans, a survey was conducted in several widely separated counties and the survey was followed by orthopedic clinics. From the data gathered in this manner, information was obtained which made possible very definite statements, with statistical proof, regarding the number of crippled children who had not had orthopedic advice, the number who had not followed the advice given them if they had been examined, the number who had been advised to carry on muscle training work or some form of physical therapy at home, and the number who had lost one or more years of schooling because of their inability to attend school.

On the basis of this information legislation was enacted to create the Crippled Children Division as a part of the State Department of Public Instruction. The duties set up for the Division were the supervision of orthopedic schools, granting transportation and maintenance aid to crippled children attending the orthopedic schools, and granting maintenance to crippled children attending high schools where such children lived too far

Director, Crippled Children Division, State Department of Public Instruction, Madison.

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to be transported daily and where the child's family was not able to provide funds for the purpose.

Because of the fact that Wisconsin has such a large rural population, the crippled children program was originally established and is still developing on the theory that every crippled child in the state should have equal advantages for both physical care and education regardless of whether he lives in a large city or in a remote rural area. With this in mind, plans were made to establish orthopedic schools in certain cities which were so located as to make it possible for the schools to serve large surrounding areas. These schools have been established in eight cities of the state at the present time but the program is only about half-developed.

When the orthopedic school program was initiated, certain governing policies were established. First, because the correction, or at least the lessening, of a disability is of paramount importance to a crippled child, no school would be established without an adequate therapy department. Second, in order to guide in the selection of adequately trained individuals to direct the physical therapy departments, appointments in the various schools would be approved on the basis of training which would qualify for membership in the American Physiotherapy Association. Third, the schools should be a community project and as such should serve the pre-school group as well as the school age group. Fourth, because so little of actual benefit can be derived from physical therapy measures by the mentally subnormal group, the same regulations should apply for enrollment in the orthopedic schools as in a regular public school. If treatment is recommended for a child in this subnormal group, he could be accepted for treatment in the physical therapy department for as long a time as his physician prescribed but he would not need to be enrolled in the school.

About one-third of the children enrolled in the orthopedic schools live outside of the city in which the school is located. The majority of this group live too far to be transported daily and are, therefore, boarded in town during the week. Through legislative provision it is possible to grant funds to cover the expense of transportation and board during the school week. In this way it is made financially possible for every child who needs the care given by the school, to receive it. No state aid is granted, however, for the cost of transportation over week-ends between the child's own home and the city where the school is located. If the parents cannot pay this cost nor the cost of board for the week-end if the child remains in town, then assistance is solicited from various organizations or from county funds for this part of the cost.

The orthopedic schools include only the first eight grades, but if a child who is in high school is in need of the treatment work as given in the orthopedic school, he is assigned a regular treatment period to suit his high school schedule and reports at the orthopedic school at that time. Arrangements may also be made for a high school student living outside the city in which an orthopedic school is located, to be boarded in town, or transported daily if he lives near enough, during the period of time treatment is prescribed.

As the work has developed, the weak points in our state program have become more pronounced. There are still seven cities which are greatly in need of orthopedic schools; and those cities are located in areas in which there are no facilities for physical therapy treatment. There is no lack of desire for such schools on the part of the community; but the delay in establishing them is due to insufficient state funds with which to pay the excess costs of maintaining these centers. When funds are available for the establishment of these other needed orthopedic schools, there will then be treatment centers fairly well distributed throughout the state.

In regard to field service, very little activity in this phase of care of crippled children has been possible due to the limited staff of the Crippled Children Division. During the first few years after the state program was initiated, it was possible to conduct thorough surveys of counties and to follow up by orthopedic clinics. During the past years it has not been possible to carry on any field service previous to the holding of a clinic. Following the clinics, most of the follow-up contacts were through the public health nurses and in counties in which there were no nurses, the only contact which was possible with the children examined was through letters written by the Crippled Children Division to the parents explaining the method by which the clinic recommendations might be followed.

These letters of explanation have proved most helpful, for many parents did go ahead on their own initiative and make the necessary arrangements for care. In many instances, however, the parents have for various reasons failed to take any steps in obtaining the recommended care for their children and for this group, it is necessary that there be adequate field service to carry on a follow-up program.

Field service is greatly needed in this state to continue supervision of the children who have been discharged from hospitals and who are not under orthopedic school care. Some of these children, especially those of pre-school age, living in small towns and rural districts, for whom corrective exercises have been recommended, require the continuance of physical therapy care as instituted in the hospitals. No definite requirements have been established as yet for the positions in the field service of the Crippled Children Division, but it is intended that the requirements be the same as those for physical therapists in the orthopedic schools.

As our orthopedic school facilities are increased and the field service established, the present hospital facilities can be utilized to an even greater degree. It has been found that the length of hospitalization of orthopedic cases has been rather low in this state due to the orthopedic school facilities. Where it is possible to place children in an orthopedic school to continue their physical therapy care, they can be discharged from the hospitals at a much earlier date than would otherwise be true.

With the passage of the Federal Social Security Act, in which provision has been made that federal funds may be appropriated to match funds granted by states for the care of crippled children, hope arises that some of the weak points in Wisconsin's program may be strengthened through the additional funds which will later be made available.

In order to meet the provisions of the federal act, it became necessary for our state to amend the present laws relating to crippled children. The federal act required that there be one agency in the state to submit a unified plan for services for crippled children. In conformity with this requirement there was created by law, an Interdepartmental Committee for Crippled Children, comprised of the Superintendent of the Wisconsin Orthopedic Hospital for Children, the State Health Officer, and the Director of the Crippled Children Division, who is to serve as secretary of the committee. Any federal funds granted to Wisconsin for care of crippled children are to be allotted to the Emergency Board to be allocated to the various state departments providing care

for crippled children, according to the plan submitted by the Interdepartmental Committee and approved by the Federal Children's Bureau. The Crippled Children's Division is to have responsibility for assembling all records on individual crippled children, for providing facilities for after-care, and for orthopedic field clinics for crippled children. The division does not have responsibility, however, regarding the facilities for after-care or diagnosis provided through hospitals, private physicians, or through private organizations. In addition, this division continues to have supervision of orthopedic schools, academic classes in hospitals for crippled children, and for maintenance for crippled children attending school.

In order to have the assistance of the State Medical Society in formulating plans for the extension of the clinic program and their advice in solving medical problems which arise in the work of the orthopedic schools, the Crippled Children Division asked the State Medical Society for a Medical Advisory Committee. The State Medical Society has kindly granted that request and a committee of five has been appointed. The members of the committee have been appointed on the following basis: one is an orthopedist, one a pediatrician, one a cardiac specialist, one represents the sections of the state far removed from large urban centers, and one, the Secretary of the State Medical Society.

For several years the Crippled Children Division has had the assistance of a cardiac committee of the State Medical Society, which has given advice regarding the supervision of children with heart conditions enrolled in the orthopedic schools. With the most helpful assistance of this committee and of the Medical Advisory Committee which has recently been appointed, the program for crippled children will be greatly strengthened.

The real pioneers in this movement in our state, have been the physical therapists who have gone into these rather small cities, far removed from orthopedic hospital centers, and have organized and built up efficient physical therapy departments in the orthopedic schools. They have established their work in communities where in the beginning few people had ever heard the term "orthopedic" and where, as some people have said, to have learned how to spell and pronounce the word "physiotherapy," was to them a real accomplishment. The work of the physical therapists has been accepted in these communities where orthopedic schools are conducted, and the value of physical therapy treatment has become known not only in these cities but in surrounding areas. The present waiting lists of children seeking care in the special schools, are proof of the success which these young women, working not only in the physical therapy departments of the schools, but in the hospitals also, have attained in acquainting the public with the value of follow-up care for crippled children.

Music and Rhythm in Muscle Re-Education

Ethel C. Scofield

Lee in his famous book, *Play in Education,* states that "Rhythm is the soul's progression." Can we then omit as important a factor as this out of our muscle re-education with crippled children.

Muscle re-education through individual exercises based on knowledge of weak muscles and easier positions eliminating gravity, given in a setting of the gymnasium or hospital, isolated from spectators and companions, after a time becomes both monotonous and mechanical, particularly when treatment has extended over months and months, and years and years. Of course this phase of treatment has its place, its need, and its results. Sometimes, however, new incentives will produce greater effort, keener concentration, and then follows better results.

Age old instincts (music, rhythm, dramatics) can be used to bring about a new interest, a new growth, a new progression. The crippled child has been shut out from all the movements so dear to the normal child: walking, skipping, running, dancing, even dressing up and parading before other children on the impromptu stage in the shed or yard where pins and pennies are the admission fee. Do you know what it means to always sit back and watch others do the things you would like to do?

James E. Roberts School, Indianapolis, Indiana

Self expression has become a big word in our modern education. The child grows, educators tell us, through self expression. How can one attain self expression bound by braces, crutches, wheel chairs, a wabbling gait, or shrivelled hand, or arm that cannot even get part way in a desired movement. The desire is there, love of taking part is there, and the imagination is stronger because it has been used again and agin in imagining plays and movements. Opportunity and direction is the big need. Opportunity is given through the special school, for it would not be fair to the handicapped children to compete in movements, dancing, or marching with the normal children. The mentality may be the same or even superior in the handicapped, but the body rated on a scale of physical ability will fall far below the normal. Mentality is graded, or shall we say we are guided in our judgment, by certain standardized responses to certain standardized questions or accomplishments. Do we not have our physical I. Q. which guides us in knowing how much to expect from a child with one good leg, or one good arm, and must we not provide every possible means of self expression to compensate for what has been taken away by illness, injury, or shock.

After massage, exercise and surgery; or surgery, massage, and exercise, has reached a limit, must the

handicapped be shut out from the joy of dancing-rhythm-dramatics. Have you ever given a group of crippled children the opportunity to take part in a stage program such as all schools give once or twice a year? All you need to do is to create the opportunity, adapt the work to their limited movements, and what the feet and hands cannot do the face and eyes will carry over. Working up a program with crippled children is a joy and pleasure—oh yes, there are hardships and it takes time and patience but the reward in the joy and pleasure that the children get, is worth all this. If you have never seen the faces of crippled children alight with joy of their first tarlatan dress, or the joy with which they wind the May pole, or the painstaking walk of the spastic to music, carrying flowers for the queen, eyes shining and faces bright, you have missed compensation that money can never give.

How, you may ask, are you doing any muscle re-education? Have you forgotten what is to be accomplished and how? In your program every number, every act, in fact every movement must be adapted to the individual need; and here is your opportunity. You cannot start your program a week or month before; it must be built up slowly and gradually through each day's work, and months and months of effort. The spastic upon whom you are spending every effort to teach to walk slowly with proper coordination, will surprise you when he or she realizes that that effort is to be used in a program, dressed in a pretty costume, with music and a stage setting. Walking means more than keeping in the footprints before the mirror in the gymnasium. Moving the arms gracefully, following the rhythm of Chopin or Shubert dressed as a flower or fairy has more incentive than daily effort before the mirror in the physical therapy room. The word of praise or commendation of the physical therapist is not the same incentive that the presence of other children, friends and parents offers. Human nature seeks applause.

Some may wonder if there is not a nervousness or self consciousness that will counteract the value. I have found that if the child's confidence has been established, he is so intent on the body movement that he seems to be oblivious to the other things. Nothing is asked that cannot be done. In working up our programs the length of performance is limited to from twenty to forty-five minutes. Few and brief are the speaking parts; music, singing, and costumes are emphasized. Movements are simple, steps emphasizing the gait desired by the physician. No child is asked to make a movement contra-indicated by the handicap. Every child in the school has a part and his part is never belittled; the simplest movement is treated as an important part of the program.

Rhythm—the soul's progression—is emphasized. Perhaps it is only simple walking across the stage, or the lifting of a weak shriveled arm, scattering of flower petals, the following of a violin bow, making of soap bubbles, or the striking of a cymbal. Beauty in music and setting develop the aesthetic side. Singing games, folk games, dramatic interpretation, give unlimited opportunity for self expression and rhythm work. Why should our crippled children be shut out from the heritage of all races. There are few that cannot be adapted in some way to the needs of the handicapped child. I have used rhythm work with normal children in the school room and on the play ground, with high school and college girls, but the keenest pleasure and most worthwhile appreciation on the part of pupils has been that coming from the crippled children. Visitors are impressed with the absolute unconsciousness of handicap and with the real pleasure shown in the shining eyes and happy faces.

Physical therapy cannot omit this valuable aid to muscle re-education. The results will greatly counter balance the extra work, and the thrill the children get from their accomplishment is worthwhile.

A Brief Outline for Treating the Birth Injured

Caroline M. Brown

The birth injured child is a crippled child which, until quite recently, was not considered treatable. He was more likely to be institutionalized and classified as mentally defective. This group as a whole includes not only children injured during birth, but any crippling condition arising in the brain. These children may be stiff and incoordinate, but they are not paralyzed in the sense that poliomyelitis patients are. As Dr. Winthrop M. Phelps points out: "In the treatment of infantile paralysis, a single disease is considered, though various parts of the body are involved and definite rules and methods of treatment may be followed which in general apply to this disease." In the case of cerebral palsy, he says: "The conglomerate group makes these forms of treatment which apply to one type entirely useless in another group." He further states: "Only recently attempts have been successful in dividing this group into types for which certain treatment will apply; since this has been started and although it is as yet incomplete, it can be said that there is definite hope for this unfortunate group."

Physical therapy is not recommended for feeble-minded children. In borderline cases, however, treatment may be advisable to determine the degree of concentration and cooperation the patient is capable of making. Although it is often difficult to determine if there is mental disturbance, it is felt that there is a much greater degree of accuracy today in mental examinations than formerly, and that these children have more of a chance.

The majority of these cases are cortical or pyramidal injuries resulting in spasticity; and basalar or extra-pyramidal injuries resulting in athetosis. In discussing the treatment, these two classifications will be referred

Physical Therapist in Chief, New Haven (Conn.) Hospital and Dispensary and Instructor in Physical Therapy, School of Medicine, Yale University.

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to, although much of this treatment may be adapted to other brain conditions, such as tremor, etc.

If the results of orthopedic, neurological and psychiatric examinations indicate treatment, the patient is referred to a physical therapy technician. It is most essential that the technician gain the patient's confidence before beginning any treatment. The first meeting between the patient and technician may be merely a mutual appraisal of one another. Getting acquainted with a patient affords the alert technician opportunity to study him carefully. She may at this time acquaint the patient with certain facts regarding his treatment. If he is old enough to understand, she may describe to him briefly certain kinesthetic facts. He should understand from the beginning that any improvement he may make in learning voluntary muscle control depends entirely upon his own effort.

If the technician does not strive to eliminate the fear of falling which is so characteristic of the spastic, there will be much delay and discouragement in recovery. The technician must make her treatment interesting. She may make many appealing suggestions about motions to stimulate the interest and cooperation of the patient. However, she should not allow gaiety or excitement to enter into the treatment period at any time. Patients soon react favorably to gentle but firm commands, although they may try at first to turn the treatment period into other channels.

Because of the characteristic nervous irritability and incoordination of these children, technicians must be calm. They must be composed and certain that nothing they may do or say will be at all stimulating. The successful treatment depends a great deal upon the right approach. The low, soft voice of encouragement invariably assures cooperation of patients. Many of the patients will prefer play to exercise. Play must be offered only as a reward for good mechanical work. A certain amount of discipline will be necessary in most cases.

The treatment of birth injuries is very highly specilized. It is not comparable to the treatment for children crippled from poliomyelitis. The infantile paralysis patients have definitely established patterns of motion but not the power to perform them. The birth injury does not know *how* to perform purposeful motions, he has never known, he has to learn. Many of these children do not know how to breathe correctly. They often have what is called *reverse diaphragm* action. They have to learn to breathe before they can learn to relax. Teaching breathing and relaxation might be considered the most difficult part of the treatment. Therefore, not only highly specialized technicians but only those who will have unlimited patience and understanding should be allowed to undertake this treatment. If treatment is started for these children, and fails because it is not well administered, they soon realize the utter futility of trying to learn. It would be better to leave them alone in their helplessness than to subject them to such despair.

One knows, from personal experience, that one cannot relax by simply being told to do so: that is, consciously. Many people need to learn how to relax. While learning they need atmosphere that is conducive to relaxation. Is it not then most unfair to expect a birth-injured child who never relaxes a moment of his life, except in sleep, to relax by being placed on a treatment table and just told to do so? He does not know the meaning of the word in the true sense. It will be helpful if he is told to sink, or any similar verb may be used that will help him to understand. Often following a treatment in a hot pool or even a hot bath, a patient will remain relaxed for some time. However, this is an artificial means of inducing relaxation, but is indispensable in many instances for teaching it. The patient may be reminded to "sink" or "float" in subsequent treatments on the table. He should be urged to remember how he felt in the pool so that he may have a better idea of what he is expected to do.

When a technician feels reasonably certain that the patient can relax, proximal joint motion may be started. If, at this time, the patient is acquainted with facts concerning the desired motions, there will not be delay due to misunderstanding. The most practical way to teach motions to one of these children is to explain to him that, while his technician is willing to assist him at first, he must perform the motions voluntarily, that any assistance he receives may stop unexpectedly and that he must try to continue the exercise without assistance.

The first motions to be taught are usually abduction and adduction of the hip and shoulder joints. The patient is urged to make this reciprocation of muscles rhythmic, remaining relaxed in order to dissociate overflow or athetosis as much as possible at the same time. There is a strong tendency to a rhythmic reciprocation because some motions are easier to perform than others. For instance, abduction may be done with difficulty and therefore slower than adduction, which may be comparatively easy to do and will be done faster. Therefore, it is advisable to decrease the range of motion, allowing only as many degrees of reciprocal motion as can be done with rhythm. The range of motion may be increased a few degrees at a time as the patient learns to control voluntary reciprocation rhythmically. Rhythm may be enhanced by jingles or soothing music, especially in training infants. Proximal rhythmic reciprocal teaching sometimes has to be carried out over a period of months before medial and distal joints may be treated. Without good shoulder control, even a highly coordinated hand is of little use.

Many patients cannot sit up or even hold up their heads. Back and neck strengthening exercises may be started very early in the treatment.

As soon as patients are strong enough to sit up, the exercise may be administered in the sitting position. The use of mirrors at this stage of recovery is an important adjunct. Mirrors may be placed at full length over the table during the non-weight bearing period of exercise. Very often they are of much value in relaxation and dissociation. Patients provided with overhead mirrors are much less likely to be distracted when they are able to observe their treatment.

Associated motions should be differentiated from confused motions because they may be used in teaching a function that it is difficult to learn. For instance, in the ankle, if dorsiflexion is performed with great difficulty because the plantar flexors dominate, resisted hip flexion will invariably elicit strong tibialis anticus response. In this way, the patient learns this motion. He should be urged to remember the sensation as much as he can for future training periods. When this motion has been learned, the association of hip and ankle function may be dissociated. Often associated motions are hard to determine. Supination of the forearm, for instance, may be associated with external rotation or abduction of the humerus or even elbow extension.

Confused or involuntary motions should be dissociated as soon as possible. When simple voluntary muscle control has been learned, more complex motions may be attempted. Combinations of joint motion should be taught with due consideration of their usefulness and adaptability to patients' various activities.

It is inadvisable to start walking until the patient

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has learned sufficient balance. Grasping parallel bars in walking does not allow the patient to swing his arms, which should aid in balancing. In some cases, walking may be learned much easier in the pool. No treatment period should exceed one-half hour, in order to avoid fatigue. However, treatment may be given twice daily.

Patients with marked head or neck athetosis may need a Thomas collar when they first begin to walk. When the fear of falling is eliminated and the excitement of being allowed to walk passes, spasticity and athetosis can be controlled better and the collar may be discontinued.

Patients with severe lower extremity involvement may sometimes be considered as "wheel chair" cases. If this is the case, treatment may be confined mostly to training the arms.

A little resistance may be used where more strength and control in voluntary motion is indicated. Water treatment offers enough resistance to be a valuable adjunct in this treatment.

If there is much muscle spasm in a spastic condition, much comfort is afforded by a firm, gentle grasping of the muscles in spasm. This grasp often aids relaxation but the patient should not be permitted to depend upon it.

Birth-injured children can be improved a great deal, although there is nothing in the nature of a miracle to be accomplished. There is more than training muscle control and coordination needed for this type of crippled children. They should feel that they are treated like normal children and be allowed educational and occupational opportunities.

In some cases operative procedure may be a necessary adjunct in the treatment of these patients. Following operative procedure, physical therapy may again be instituted upon the advice of the orthopedic surgeon.

It is felt that improvement continues as long as treatment is given. It is most disheartening for technicians to find that a patient, capable of performing motions well for her, may not do so for another person—the doctor, for instance. This means that the pattern of motion is not yet well enough established to carry over. Since this is true in the majority of cases, it means endless training. Technicians may be comforted by a remark once made by Dr. Steel F. Stewart of California. He said: "The cortically rigid are like the little dog that has learned to sit up on its hind legs for a reward and then immediately reverts to 'all fours' again."

It will be noticed that much has been said about mechanical training. It is felt that this cannot be overemphasized in order to teach proper motion patterns in the beginning. As soon as the patients begin to understand simple muscle reciprocation, they may begin to do interesting things, such as are provided by play and occupation.

A differential muscle examination to determine which muscles are the most spastic is of primary importance and should be made in each case in order to record improvement adequately.

Back Strain and Sciatica

(Abstract)

Frank R. Ober, M.D., Boston, in J.A.M.A., 104:18: 1580, May 4, 1935.

Treatment

The treatment of this condition resolves itself into one factor, and that is the relief of the contracture. In those cases in which there is no sciatica or other pain, the low back pain may be relieved by stretching exercises carried out in the following manner:

The patient stands with the affected side about two and one-half feet away from a table or some other convenient object, which he grasps with one hand; then, with his shoulder and pelvis in the same plane, he bends the affected hip toward the table as far as he can, his whole figure forming an arc. This position is maintained for a few seconds and then repeated five times the first day and is increased once each day until the exercise is done twenty-five times, twice a day.

In those cases in which there is a severe sciatica, operation is indicated.

Several patients with low back symptoms and severe sciatica have been operated on, some of them with almost dramatic results. These patients have suffered from severe sciatica, lasting, in many instances, for several months. In cases one and three the relief from sciatic pain was almost immediate, there being a marked diminution of symptoms within twenty-four hours following operation. In several of the other cases the sciatic pain persisted for about six weeks and in one case lasted for eight weeks after operation, the sciatica subsiding very slowly. Thirteen patients have been operated on, with relief in all instances except one.

Before the surgeon does this operation he should be very sure that there is no pathologic condition in the spinal canal, especially in the region of the cauda equina. The explanation of the amelioration of the sciatic symptoms and the low back disability might possibly be made on two grounds. First, that the shortness of the iliotibial band and the contracture of the fascia lata causes a squeezing effect on the sciatic nerve where it passes over the acetabulum. Second, an explanation which seems to be more reasonable, that the mechanical pull of the contracted bands or band is producing a mechanical strain of the sacro-iliac or lumbo-sacral articulation.

Summary

The chronic lame back problem has not yet been solved.

The contracted facia lata is a common cause of lame backs and has been unrecognized.

If this is so, it would seem, in the presence of normal roentgen studies, that fusion of the sacro-iliac or lumbo-sacral regions should not be done.

When the fascia lata is contracted, it must produce bad posture.

Therefore, apparatus designed to hold the abdomen or the back, or exercises given to straighten the back will be ineffectual against such severe contractures.

The method of treatment proposed is so simple and so beneficial that it should have a place in the armamentarium of the surgeon.

No attempt has been made in this article to discuss other known conditions that cause low back disabilities.

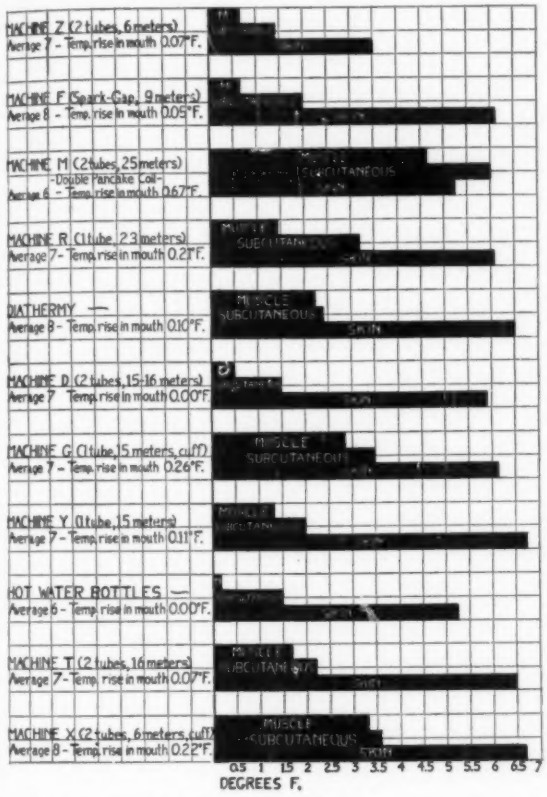
Tissue Heating by Short Wave Diathermy

Bernard Mortimer, Ph. D., M. D.

and

Gertrude Beard, R. N.

Following the technic described in a previous article,[1] nine new short wave diathermy machines were tested for their ability to heat the tissues of the human thigh. As before, the machines were used in rotation, and the dosage was regulated entirely by the tolerance of the patient. A representative of each manufacturer was present at one test to direct the usage of his machine.


MACHINE Z (2 tubes, 6 meters)
Average 7 - Temp. rise in mouth 0.07°F.
MACHINE F (Spark-Gap, 9 meters)
Average 8 - Temp. rise in mouth 0.05°F.
MACHINE M (2 tubes, 25 meters)
-Double Pancake Coil-
Average 6 - Temp. rise in mouth 0.67°F.
MACHINE R (1 tube 23 meters)
Average 7 - Temp. rise in mouth 0.27°F.
DIATHERMY —
Average 8 - Temp. rise in mouth 0.10°F.
MUSCLE
SUBCUTANEOUS
SKIN
MACHINE D (2 tubes, 15-16 meters)
Average 7 Temp. rise in mouth 0.00°F.
MACHINE G (1 tube, 15 meters, cuff)
Average 7 - Temp. rise in mouth 0.26°F.
MACHINE Y (1 tube, 15 meters)
Average 7 - Temp. rise in mouth 0.11°F.
HOT WATER BOTTLES —
Average 6 - Temp. rise in mouth 0.00°F.
MACHINE T (2 tubes, 16 meters)
Average 7 - Temp. rise in mouth 0.07°F.
MACHINE X (2 tubes, 6 meters, cuff)
Average 8 - Temp. rise in mouth 0.22°F.
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7
DEGREES F.

Temperature rises in human thigh. Current on for twenty minutes. Technic directed by the manufacturers. Dosage regulated by tolerance of patient.

The machines submitted were (wavelengths listed are those quoted by the manufacturers):

Machine X—2 tubes, 6 meters.
Machine T—2 tubes, 16 meters.
Machine Y—1 tube, 16 meters.
Machine G—1 tube, 15 meters.
Machine D—2 tubes, 15-16 meters.
Machine R—1 tube, 23.31 meters.
Machine M—2 tubes, 25 meters.
Machine F—Spark-gap, 9 meters.
Machine Z—2 tubes, 6 meters.

A conventional spark-gap diathermy machine was used for comparison.

In addition to the machines listed, it was decided to run comparable tests with two hot water bottles, one on the medial and one on the lateral aspect of the thigh. The temperature of the bottle was maintained at from 43 to 45 C. by an electrical heating element inserted through a rubber stopper.

Temperatures of the skin, of the subcutaneous tissue and of the muscle (quadriceps extensor) were taken before and after a twenty minute clinical application by the thermocouples and potentiometer described previously. Mouth temperatures were also recorded. The accompanying graph illustrates the results that were obtained.

Since several manufacturers had submitted cuff electrodes as additional equipment, two tests were carried out using cuffs with the conventional diathermy machine. The following average temperature increases were observed:

Skin, 8.8 degrees F.
Subcutaneous tissue, 9.95 degrees F.
Muscle, 8.8 degrees F.

To date, fourteen short wave diathermy machines with wavelengths ranging from six to twenty-five meters have been tested for their ability to heat the tissues of the human thigh. From our results there appears to be no advantage of any one wavelength over another for heating purposes.

1. Mortimer, Bernard, and Osborne, S. L.: Tissue Heating by Short Wave Diathermy: Some Biologic Observations, J. A. M. A. 104: 1413 (April 20) 1935.

Aided by a grant from the Council on Physical Therapy of the American Medical Association.

From the Department of Physiology and Pharmacology and the Department of Physical Therapy, Northwestern University Medical School.

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The Crippled Child

John Louis Parks, M.D.

I. History

Crippled children born of primitive parents were doomed to die young. Civilization has multiplied their number and increased their chance for a longer life. It may be assumed, with a fair degree of assurance, that deforming and crippling conditions of childhood were far less frequent among prehistoric people than among modern civilized nations. It seems even safer to assume that present methods of living provide for a much greater chance of survival for the deformed child.

The savage baby, born of hardy parentage, breast fed, exposed to sunlight and cold, subjected to the rapid migration of the family or tribe, had to be physically strong to exist. The sickly and deformed perished. When the entire structure of primitive life depended upon strength, endurance and speed, there could be but few excuses for protecting the physically handicapped. It is probable that only an occasional chieftain or warrior, injured heroically, was honored and cared for because of his disability.[1]

If death for the deformed was a necessity among primitive people, it became a plan and policy among the Greeks and Romans. Even good Christians developed a highly destructive emotional repulsion for the "evil monsters." The Spartans practiced infanticide with impunity. The Greeks, aiming at bodily perfection, destroyed the imperfect as a logical, cold and scientific procedure.[2] Yet from this period at least two men of Greece stand out in spite of their maimed bodies. Pittakes, King of Athens, warrior, statesman, philosopher and poet, is thought to have been lame.[3] Aesop, writer of fables, originally a slave, has been represented as a perfect monster of deformity and ugliness, a description for which there is no authority in the classical authors.[4]

That the Romans regarded a deformed human being as an ill omen is shown by the derivation of the word monster from the Latin "monere," meaning to warn.[5] Every Roman *pater familias* had the right to destroy his children. If he wished to cut short the life of a cripple—an ill omen to his house—he was not called to judgment.[6] However free the Romans may have been with regard to infant destruction, they made the first recorded provision for cripples. Pope Gregory, in 590 A.D., included them in his classification of the infirm and destitute to be supported by public funds.[7]

Perhaps one of the greatest handicaps in social adjustment for the deformed grew out of the text of the Old Testament. In the Christian church the cripple became an object of scorn and a target for emotional rebuff. "Deformity became a sure sign of spiritual degradation."[8] "For whatsoever man he be that hath a blemish, he shall not approach: a blind man, or a lame, or he that hath a flat nose, or anything superfluous, or a man that is broken footed, or broken handed, or crookback, or a dwarf, or that hath a blemish in his eye, or is scurvy, or scabbed, or hath his stones broken . . . he hath a blemish: he shall not come nigh to offer the bread of his God."[9] Biblical laws were interpreted altogether too literally for the comfort and safety of a cripple in the early days of Christianity. Their influence has remained on up through the ages of witchcraft, which isn't so far removed from our time.

Little is known concerning the state of crippled children during the Dark Ages, but it seems safe to say that with fever, pestilence, famine, and ceaseless conflicts, few debilitated children survived.[10] However, it is known that during the Medieval period mature cripples were uncommon enough to be in great demand as jesters and buffoons to ornament regal courts. The more grotesque the deformity, the greater the mirth.[11] These misshapen creatures of chance were allowed great liberties of speech and conduct in the courts of kings and halls of barons as long as their drollery provided a laugh.

Out of this same period another influence on the cripple developed. Roman slave owners exposed their deformed subjects on the public thoroughfares for the purpose of collecting donations. The more pitiful the subject, the greater the public sympathy. Children were purposely maimed to increase their appeal.[12] Begging by the cripple became a very common practice in southern Europe and Asia. It is a practice which persists throughout civilized nations today.

The Protestant Reformation brought with it additional hazards for the crippled. He dare not make himself too conspicuous or too seclusive. In either case he would be considered a sorcerer and his fate rested with the impulsive demands of a frenzied populace. He might be blamed for any public or personal disaster. In the time of Luther the belief was current that "the Devil helped maidens to the joys of motherhood against their wishes . . . relation with the Devil must result in most horrid monstrosities."[13] Thus in the sixteenth century, Luther advised that a rachitic baby be thrown into the river in order to rid the world of this work of the Devil.[14]

Centuries of scorn, isolation and contempt for the crippled left its impression on the common people. "The uncanny appearance of a being in miniature, or crippled, was repulsive and in itself suggestive of something malignant. This view has held throughout the development of human civilization, Chinese, Indian, European and American. Religions of high and low morality, ancient and modern alike, abhorred this unfortunate and heaped curses upon him."[15] Hatred, isolation and fear had their compensatory effects on the cripple. He developed guile, malice and secrecy as weapons of physical protection. Thus King Richard, "a man ill-shaped, crooked back, lame armed, withal valiantly minded, but tyrannous in authorities . . ."[16] laid elaborate and sinister plans in his ascension to the throne. Alexander Pope's deformed and weakened body was a constant source of humiliation and suffering throughout his life and probably played a significant part in the treachery and deceit which shadows his brilliant literary career.[17] A century later Lord Byron was cursed with a club foot which had a lasting influence on his short but illustrious life.[18]

Assistant Resident Physician Department of Obstetrics and Gynecology, Wisconsin State General Hospital.
A thesis submitted for the Degree of Doctor of Medicine, University of Wisconsin.

Horwitz offers as causes for dislike or fear of the deformed four reasons:

1. Dislike for the imperfect as among the Hebrews.
2. Economic reasons. The knowledge that he will be a burden upon the community, contribute nothing to the state, or that he will make a poor soldier.
3. Idea that an imperfect body must harbor an imperfect mind as among the Romans.
4. The fear that the evil spirit must be concerned in the production of the monstrosity as among the Europeans of the Middle Ages.[19]

Not until the eighteenth century did people cease to think according to religion and examine life and the world in terms of human experience and reason. . . The voice of the right to live surged up against the Church and the State." [20] However, the eighteenth and nineteenth centuries were to be marked by a social system far more productive of physical deformity than had ever been witnessed before.

Extreme poverty, ignorance, crowded and unsanitary housing, low wages, long hours, child and woman labor mark the eighteenth century as a dark period for general social welfare. Children three to six years of age working twelve to fourteen hours a day in crowded rooms of unsanitary cottages at lace making, knitting, embroidering, and women working in factories and mines under all forms of filth, exposure and malnourishment, could result in nothing but distorted bodies, maternal fatalities, blindness, chronic ill health and ignorance.[21] There was a close relationship between crippling diseases and economic conditions. Together they created a large public problem which gradually began to attract the attention of the multitude. Industrial abuses were exposed as potent factors in the production of deformity. Of all things which produced crippling, social causes seemed most amenable to correction.

In the latter half of the nineteenth century social reaction and emotional appeal began to develop in behalf of crippled children. Orthopedic surgery became a scientific, if somewhat experimental, study. The curative value of sunshine was rediscovered. "The Royal Bavarian School and Home for Crippled Children," a convalescent home, was opened in Munich by John Nepimak in 1832. This movement spread throughout Germany, England, Switzerland and Italy. In 1863, the Hospital for Ruptured and Crippled Children opened in New York. In 1872, the first attempt at industrial education for crippled children was started by Pastor Hans Knudsun in Copenhagen, Denmark." [22] The nineteenth century closed with little attempt at prevention, with inadequate accommodation and insufficient treatment in general hospitals, and as the army of cripples was no longer reduced by high mortality, the problem was causing deepening public apprehension."[23]

The twentieth century brought with it new hope for the crippled. After ages of neglect, society rapidly began to take over the duties of educating and preparing these unfortunates for substantial places in life, free from the abuse and ostracism of the past. Just as social agencies for the advancement of handicapped children were becoming organized, several major events were to take place in rather rapid order. The World War came on. Great demand was created for technically trained men. It was at that time that Franklin D. Roosevelt crossed out a Navy regulation which had held since 1776 in order to enlist the services of two engineers each of whom had only one arm. Both made excellent records in the United States Naval Service.[24] And there was the little Marquis of Villalobar, Spanish Ambassador to Belgium during the war, whose "grotesquely truncated figure" stands out as one of the most colorful individuals of the great encounter.[25] The vast majority of less distinguished cripples either made themselves useful by virtue of their selected abilities or more burdensome, in a time of need, because of their incapacities. Orthopedic surgery was in a stage of scientific development which was enhanced greatly by wartime experiences, especially in plastic work, bone grafting and fracture repair. Physical and occupational therapy were natural post-war developments which have contributed greatly to the welfare of all cripples.

In 1916 a great pandemic of infantile paralysis swept over a world unprepared to comprehend or combat a disease which left in its wake hundreds of thousands of men, women and children incapacitated. Lesser epidemics of this dreaded disease have recurred, only to stimulate a great mobilization of all sources to combat its deforming and sometimes fatal effects.

During the last twenty-five years, state maintained and privately endowed orthopedic hospitals have advanced in numbers immensely. Orthopedic schools have grown to meet the ever increasing demand for special education of the crippled. In the Declaration of Geneva, in 1924, justice for the children of all nations, as expressed in "The World's Charter of Child Welfare," provides that clinics for orthopedic work be established and that crippled children all over the world be instructed and cared for.[27]

Thus we see that facilities for serving orthopedic needs and instruction for the handicapped have developed rapidly during the first third of the twentieth century. Prevention, the key to all medical care, still remains a dark chapter in the control of many of the causes of crippling. Practically every community still has its cripples, and sad it is to know that many of these unfortunate children could have developed normally if they had not been neglected by uninformed or ignorant parents or if they had been treated adequately in the early stage of their disease.

II. Prevalence and Prevention of Crippling Conditions

"It can never be realized too widely that deformity is an unnatural and preventable affliction which treatment may alleviate or cure, but which a more complete understanding could abolish."—Sir Robert Jones.

It is estimated that there are between 300,000 and 400,000 cripples in the United States and that fifty per cent of them have preventable deformities.[28] In Wisconsin there are about 9,000 cripples under twenty-one years of age who have normal mentality but who have physical deformity serious enough to prove a handicap in earning their living.[29] According to definition, a crippled child in Wisconsin is "one whose activity is so far restricted by loss, defect, or deformity of bones or by affections of the neuro-muscular system as to reduce his normal capacity for education or self support.[30] An analysis of 2,610 reported cases in Wisconsin at the age of onset of disability revealed that seventy-eight per cent were affected under seven years of age, nineteen per cent from seven to fourteen years of age, and three per cent were involved from fourteen to twenty-one years of age.[31] Somewhat similar statistics are found in other surveys of the United States.[32] This information makes it apparent that the problem of practicing preventive measures, with regard to crippling conditions, rests primarily upon adequate attention to the preschool child.

It is interesting to find that in a study of the time elasping between onset of the disease and the first orthopedic examination in 2,016 cases in Wisconsin, twenty per cent were examined less than one year after onset,

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thirty-five per cent were examined one to five years after onset, twenty-nine per cent were examined five to ten years after onset, and sixteen per cent were examined ten or more years after onset.[33]

The causes of childhood deformity fall under the following four general headings: 1. Infection; 2. Congenital; 3. Traumatic; and 4. Developmental. A brief survey of the incidence and methods of prevention of the more common conditions coming under the above general classification, without reference to detailed etiology, pathology and operative treatment, will be taken up in the order of their relative importance.

INFECTION

Poliomyelitis:

Poliomyelitis probably causes more crippled children than any other single disease. It is generally considered that it accounts for over one-third of all crippled children. R. I. Harris of Toronto estimates that forty per cent of the deformities of crippled children in Ontario are due to infantile paralysis.[34]

This is an infectious disease, supposedly caused by an ultramicroscopic organism which has a special destructive affinity for the anterior horn cells of the spinal cord. Poliomyelitis is endemic throughout civilized countries. It usually reaches its highest incidence in the summer and fall months. "An analysis by the United States Public Health Service shows that throughout the country about one paralytic case per 100,000 population may be expected between the first of December and the first of June each year, and in the other six months about four to fourteen cases. The maximum of paralysis is reached in September."[35] Poliomyelitis not infrequently reaches epidemic proportions and in 1916 swept the United States, afflicting 27,000 persons, eighty per cent of whom were under five years of age.[36] Epidemics of lesser proportion have recurred in the United States and Canada in 1927, 1929 and 1931.

Adequate preventive measures for the control of poliomyelitis have not been perfected to date; but, in the light of what is known concerning the disease, early recognition of the symptoms and signs of the infection both by the parent and by the doctor, and immediate, early preparalytic treatment will prevent a great majority of the disasters which accompany it. Parents should know that headache, poor appetite, tiredness, billiousness and upset bowels, fever and flushing, irritability, stiff, painful back and neck, and sleepliness indicate an abnormal reaction for the child. They should be alert to recognize any or all of these symptoms as those which precede the paralytic stage of poliomyelitis. Upon the family physician rests the great responsibility of being informed and equipped to administer immediate medical care. Early diagnosis is essential. Acute cases should be isolated. Persons who have come in contact with the patient should be quarantined for twenty-one days from the date of last exposure. Concurrent disinfection of the nose, throat and bowel discharges and soiled clothes and terminal disinfection of the premises should be carried out.

Bed rest, convalescent serum and watchful, careful prolonged treatment of paralyzed parts play the most important part in the present methods of preventing deformity from poliomyelitis. That convalescent serum is of prophylactic value seems to be indicated by various reports. In Manitoba fifty-seven children beginning to be ill during the epidemic of 1928 were treated with serum before paralysis happened. Not one died. Four had paralysis after recovering from the attack. Fifty-three recovered completely with no paralysis. Out of eighty-seven other children who had the disease in Manitoba at the time, who either did not receive serum at all or who received it late after paralysis had begun, seventeen died, forty-eight had paralysis after recovering from the immediate attack and only twenty-two recovered completely.[37] On the other hand, Dr. William H. Park, New York City, reports, "we have found that the percentage of cases which developed the paralytic symptoms, was about the same as in the case in which the serum was not used. No harm resulted from the treatment, but it was apparent that no benefits resulted."[38]

The advantage of serum treatment remains a debated question and, at best, a limited procedure. What the future will be in the prevention of poliomyelitis remains to be seen. In the meantime, early diagnosis, bed rest, isolation and care of the paralyzed parts will aid a great deal in controlling the disease and in preventing serious deformity following the acute stage of the infection.

Tuberculosis of Bones and Joints:

Tuberculosis is second to poliomyelitis as a causative factor in the crippling of children. There are about one hundred and fifty special institutions in this country for the treatment of surgical tuberculosis.[39]

Tubercle bacilli are the organisms which cause the disease. They are of two sources, human and bovine. The human form of organism cause the greatest amount of bone and joint involvement, but the bovine source of infection is the most amenable to eradication and certainly should not be overlooked.

Once a joint or bone is involved with tuberculosis, the best results to be hoped for are arrest of the process through proper medical and surgical treatment. An involved joint can never be restored to full function. Damage has been done; ankylosis invariably results. Therefore, it seems that the logical method of attacking this disease is through prevention of contact with the organisms or through the production of an active immunity by vaccination with a virulent organism.

Since Koch discovered the tubercle bacilli in 1882, slow but steady progress has been made along both lines of prevention. Pasteurization of milk and the elimination of tuberculous cows from dairy herds have made milk safer for about half of the people. In 1928, about forty-five per cent of the population was served with a milk supply that was not under sanitary control and some of the remainder of the country's supply was far from being safely protected.[40] The leading dairy states such as Wisconsin and New York have practically eliminated tuberculous cows from their dairy herds. Other states have followed in this movement and it will be only a matter of time until all milk offered for public sale will be either pasteurized or from tuberculous free herds, or both.

But what hope is there of preventing the human type of tuberculosis? Unfortunately enough, progress has been slow and faltering in solving this problem. Although the infectious nature of the disease has been known for years, individuals with active phthisis are still allowed free association with non-infected persons. Clinical research into the advantages or disadvantages of being minimally infected with tuberculosis through contact with the disease has been carried out extensively. The results of such research have offered material for heated debates between the followers of both theories.

Out of all of the research that has been done on tuberculosis, two men, Calmette and Guerin, will probably stand out as the greatest figures in the control of the disease. For years, Calmette has worked diligently to isolate a strain of hereditarily and fixedly avirulent tubercle bacilli. His efforts have been condemned by many

reactionary researchers, but he has remained steadfast in his purpose. Apparently he has won, but few share with him in his victory. The medical profession has been slow to accept his contribution. However, in France, 336,000 children had been inoculated up to May 1, 1931. More than a million children had been vaccinated in the world. No accidents had occurred. What were the results? Calmette says that the infantile death rates, due to tuberculosis, of those vaccinated fell almost to zero.[41] The general mortality of the vaccinated children was notably diminished.[42] The method consists of vaccinating children as soon as possible after birth with an inoffensive infection before they have been attacked by a virulent organism. The Pasteur Institute has put BGG cultures gratuitously at the disposal of the sanitary services of the world.[43a] The Lubeck catastrophe in which sixty-seven out of two hundred and forty-nine children vaccinated from February twenty-fourth to April twenty-fifth, 1930 died of tuberculosis makes it apparent that strict control of this procedure is essential.[43b] The accidental contamination of avirulent vaccinal suspension with virulent human organisms was an unfortunate circumstance in the development of a logical method of controlling tuberculosis. It seems that this method of prevention should, in time, be adopted by all health centers. Tuberculosis of the bones and joints can be prevented only by some such method.

Osteomyelitis:

Osteomyelitis is next in the infectious causes of crippling. It is not an uncommon disease. It is not entirely preventable; but an understanding of the causes and early symptoms followed by immediate and proper treatment by a competent surgeon will practically always minimize the suffering and deformity resulting from this condition. Children are more frequently infected than adults. They usually have a history of trauma to one of the long bones, of a blister on the heel, or of infection near the bone. Symptoms of the disease usually develop rather acutely. They are characterized by extreme pain close to but not in the joint, general malaise, headache and fever. Surgically this condition presents the same emergency problem of an acute appendicitis and should be treated as such. Immediate surgical drainage while the process is localized is essential. Prolonged, careful after-treatment is usually required.

Infectious Arthritis:

This is a disease which commonly involves children. The relationship between joint involvement due to streptococcus foci of infection and organisms of the rheumatic chain is not a closed chapter in medical research. Early diagnosis, rest, eradication of foci of infection and vaccine therapy seem to be the outstanding methods of controlling this condition.

Perthe's Disease and Encephalitis:

These are other less common infectious causes of childhood deformity.

CONGENITAL

In congenital deformities, the statement of Sir Robert Jones with regard to the needs of crippled children seems most appropriate. He said, "1. Get them early, 2. Overcome parental ignorance, 3. Plan early evacuation from the hospital into convalescent homes and into special schools."[44] Certainly the first and second needs are necessary. Congenital dislocation of the hips, club foot, torticollis, congenital syphilis, and rarer congenital defects require the cooperation of obstetricians, pediatricians, parents and nurses in the early identification of these deformities.[45]

The orthopedist can practically always correct club foot when the child is brought to him in the second or third month of its life. Congenital dislocation of the hips can be corrected best when treatment is instituted before six years of age. Torticollis may be rectified by a relatively simple operation which gives best results when performed during the sixth year of the child's life. Parents must be educated to give those advantages to their misshapen offspring early. The fear of surgery should be overcome by honest conviction that surgery will be of benefit to the patient. Parents are apt to think that their child is the exception and certainly he is if he has a congenital deformity. The child uses his unfortunate condition as a power device to prevent hospitalization. Parents become allies in his feelings and cannot endure the thought of separation or of arbitrary handling of their pet by doctors and hospital attendants.[46]

Because a good majority of the orthopedic conditions require long and prohibitive periods of hospitalization well out of the range of the common wage earner, and because of the general social interest in crippled children, orthopedics hospitals are rapidly becoming organized centers of social or state medicine. Mothers are beginning to realize the advantages of such institutions and once the child has experienced hospitalization under intelligent and sympathetic supervision his fears are usually dispersed.

Other important, but less frequent, congenital defects than those listed above are: congenital multiplicity or absence of parts, spina bifida, hydrocephalus, myotonia, congenital athetosis, and glandular disturbances influencing physical growth. There is some question concerning the category of spastic paralysis. I have included this condition under the traumatic causes of crippling.

TRAUMATIC

Birth Injuries:

Because of the variety of ways of reporting these cases and because of the confusing statistics which result, no attempt at estimating birth injuries, in actual numbers, will be made. The mentally handicapped spastic cases are usually not included in state reports of crippled children because they are not included in the routine educational system. Also, all spastic cases do not result from birth injury. It is apparent, however, that birth injuries are far too common and that the medical profession is largely responsible for their prevalence and for their care. As to whether or not the etiology can be attributed to physiological or instrumental trauma at the time of birth or to congenitally inferior nervous and vascular systems are much debated questions, with evidence for both views. It seems hardly within the scope of this paper to go into great detail concerning unknown factors.

Birth injuries may be divided into four general groups:

1. Peripheral nerve injuries to the brachial plexus.
2. Cervical motor root avulsion.
3. Spinal cord injuries.
4. Intracranial injuries:

a. Cortical injury to the pyramidal system (motor area).

b. Cortical injury to the non-motor area.

c. Subcortical pyramidal tract injury.

d. Subcortical extra pyramidal injury.[47]

The first three groups are almost invariably related to trauma at the time of birth. The fourth group represents the greatest unknown quantity, but the etiology, in the vast majority of cases, is intracranial hemorrhage, whatever the cause, as or near the time of birth.

Ehrenfest distinguishes between physiologic trauma-

tization and true pathological birth injury. He presents some interesting data. Nystagmus is present in thirty-five per cent of all babies born by normal labor; in eighty per cent of the first born, and in one hundred per cent of those born following abnormal presentation. Retinal hemorrhage, within the first twenty-four hours of extra-uterine life is present in twelve per cent of all infants. Smaller and larger hemorrhages are found in the brain substance at autopsy in about sixty-five per cent of all young infants.[48]

Schroeder reports a study of one hundred and forty-six cases of infantile palsy. In 48.3 per cent there were no pregnancy or labor difficulties; 15.2 per cent were delivered instrumentally; 22.8 per cent were born after long and difficult labor, and 4.8 per cent were born premature.[49]

Ford states, "Obviously any condition which increases the stress which the foetal head sustains in its passage through the birth canal will increase the chances of injury. Contracted or malformed pelves, rigid soft parts, precipitate or prolonged labor, abnormal presentation, high forceps deliveries, breech extraction, or over-large foetal heads are all common factors which predispose to birth injury."[50]

Birth injuries represent by far the greatest percentage of intracranial lesions which are not progressive. "The damage is done; the picture is complete. No further damage or progression may be expected."[51] The difficult problem of training spastic children will be taken up briefly in the chapter on education.

What can the obstetrician or general practitioner do to reduce the incidence of birth trauma? "Physiologic traumatization of brain and meninges can be reduced to its possible minimum by absolute non-intervention during labor that is progressing normally, excepting in this respect, an episiotomy and truly perineal forceps applied to a maximally compressed head. If in the interest of either the mother or the child intervention is considered necessary, haste almost invariably will increase the danger to the child. Serious harm may be obviated if the seemingly asphyxiated child is always considered as probably having been intracranially traumatized.[52]

Every person who practices obstetrics should be adequately prepared to handle all cases, should always be available when needed, and should practice conservative procedures. Birth injuries would be decreased by adherence to these simple principles. Obviously they are grossly abused by many who attend childbirth.

Accidents:

There are twice as many children of school age killed by accidents as die from any one disease and the National Safety Council reports that there are thirty-four non-fatal to one fatal accident.[53] Safety education should be taught to all school children. Everyone should be cooperative in the prevention of accidents.

Childhood and old age are the periods in life when traumatic fractures are most apt to occur. The improper treatment of a fracture in childhood will often result in deformity for life. Fractures require more than first aid consideration and "no fracture is properly handled unless in the long run it secures to the patient the maximum of function and the minimum of deformity possible under the conditions."[54]

DEPARTMENTAL

Rickets is the most important crippling condition under this heading and deserves mention because it is one of the most easily preventable of all physical deformities. Rickets varies greatly in incidence to different localities. It presents a problem of some concern especially in urban centers. Through exposure to sunshine, proper diet, and cod liver oil it can be entirely prevented.

Kyphosis, lordosis and scoliosis are other developmental conditions which require early diagonsis and treatment during the formative period of a child's life.

III. Education

"The education of the crippled child is not philanthropy—it is enlightened self-interest."[55]

In the past only the wealthy cripples have had any opportunity for education. And even they have been handicapped by a lack of orthopedic knowledge on the part of the medical profession.[56]

For any community, either state, county, city or rural district, undertaking to provide an adequate education for its crippled children three major problems are notable, namely—

1. To discover the number of children who must have special facilities and services if their opportunities for cultural education and training for productive citizenship are to equal those of normal children.
2. To determine the best method of securing these special advantages to each child within the range of his mental ability and physical potentialities.
3. To finance the program of special education which is, of necessity, more expensive than that of the normal child in the same community.[57]

Out of more than 300,000 crippled children in the United States, at least one-third, or 100,000 need special education.[58] This army of crippled children is unevenly distributed throughout the country. Their welfare becomes a state and local problem and rightly so. It should be the duty of the state through legislation to provide, either directly from the treasury or from the county from which the child comes, the price for adequate care and education. Ninety per cent of the children lack the price of proper care.[59]

Since 1900, when the first public school for crippled children was opened in Chicago,[60] the trend in education of the physically handicapped in the United States has been toward orthopedic divisions in the regular systems of local public schools. Local school boards now receive state aid for educating handicapped children in twenty-one states of the United States.[61] The methods of extending state aid vary somewhat with the different states. With public school classes for the majority who do not need hospitalization, the problem of providing education for the physically deformed children in the United States has rapidly progressed during the last two decades. State maintained and privately endowed hospital schools together with the public schools are now keeping the scholastic training of a handicapped child running continuously and smoothly to its logical conclusion—a well rounded education and training for a job—in spite of time out for necessary physical repairs.

A short analysis of the plan of the hospital school and the orthopedic school will disclose that their educational purpose is the same although the equipment and type of teaching varies somewhat.

In England and the European countries, hospital schools still assume major responsibility for both treatment and education of crippled children. The responsibility is primarily the doctor's. He must lead the way in restoring the child as fully to normal as possible and if that is necessarily long, he must see that education modified to suit the particular needs of the child is available.[62] Great Britain has both orthopedic hospital and open air schools. Each has a staff of surgeons, nurses, attendants, board of education teachers, curative work-shops and after care clinics.[63]

The English[64] and the Swiss[65] lay particular stress upon the after care of those whom they train. They attempt to individualize each student as an apprentice to one of the various trades or professions.

American orthopedic hospitals for children have about the same plan as those of Great Britain with the exception that patients are returned to their home communities or to boarding homes near orthopedic schools as soon as hospital care is no longer indicated. Probably the placement of crippled children trained in orthopedic schools and hospitals in the United States does not compare quite as favorably as with other countries where employers are not only encouraged, but are forced by law, to employ a quota of physically handicapped people.

The orthopedic division of a public school may be located in some portion of an elementary school building or in a building apart from the regular school grounds. Admission to special classes depends upon an orthopedic examination. Usually mental placement tests and tuberculin tests are also given. What constitutes a crippled child varies with the laws of different states. The number of children allotted to one teacher varies with the average intelligence of the group. Usually classes are smaller than regular classes because of the greater amount of individual teaching which handicapped children require. Regular academic studies of the grade level suited to the mental age of the individual constitute the class work. Modern orthopedic schools are equipped with physical therapy departments where massage, water, and heat treatments along with corrective gymnastics are given as indicated by the individual need of each child. Most schools have specially equipped seats, ramps along the walls, cork covered floors, and various other conveniences to suit the needs of the children. Instead of accepting the child's infirmity and endeavoring to make things as easy as possible for him, some of the more recently constructed orthopedic schools have been built to approximate ordinary class room conditions. By so doing, it is thought that the child's initiative to meet and overcome normal obstacles will be developed.[66]

Most school systems arrange for transportation of the crippled children. Lunch is usually served at the school. For those who need them, rest periods are arranged. The teacher is the biggest factor in the success or failure of orthopedic school education. More will be said about her later.

Two types of crippled children require consideration in special education. They are—

1. The temporary cripple who differs only a slight degree from normal, and

2. The incurable or severely handicapped by permanent deformity.[67]

The temporary cripple, with combined care and education, recovers and returns to the normal school room without embarrassing loss of scholastic standing. The second group presents a much more difficult problem, but by no means should their education be hopelessly disregarded because of permanent physical defects. Not infrequently mental deficiency, a further complicating factor, is met with.

Instruction of the mentally subnormal child differs from that planned for the mentally normal. Where a child has a moronic or lower level of intelligence, it is practically impossible to handle him in a class room with intelligent children. He will have to be sent to an institution or receive private care and instruction.

The crippled child of a middle or upper social status is apt to have been pampered and petted at home; the child from lower social order has frequently been abused and neglected. All sorts of personalities are represented in a group of crippled children. The emotionally unstable are apt to cause considerable class room disturbance. Regulation by the group instead of the individual is frequently a new and beneficial experience for the cripple.[68] Educators now agree that the advantages gained from segregation far out-balance the disadvantages in the case of children with sensory and motor defects. The argument once used against segregation was that it made the boys and girls feel "different." The crippled child feels more sensitive when competing with boys and girls who are able to run and play than he does with a group of children who have handicaps similar to his own. The fundamental consideration in planning a crippled child's education is setting reasonable goals for his achievement. The ability of each individual child must be taken into consideration so that he may meet success instead of failure as he goes along in his work. If he does not, he is often turned to a life of fantasy. Studies are assigned to fit his capacity. Games are selected which he is able to play. Room equipment is arranged so that he can help himself. He is surrounded by sympathetic understanding, but not by sentimental commiseration. The daily experience of feeling adequate to the situation, builds up self-reliance, confidence and emotional stability.

To direct a class of crippled children intelligently it is apparent that the teacher should be especially trained for the work. She should have a basic knowledge of the underlying pathology, psychology and mental ability of each student as well as some technical training in muscular, skeletal and nervous mechanisms. She should, in addition, be a good teacher with a pleasant, calm and understanding disposition.

Standard school tasks may be entirely out of line with a particular student's ability and should, therefore, not be forced upon him. For instance, a spastic pupil may not be able to get far with penmanship lessons, while if he is given a chance to express himself on a typewriter, the result may be surprising. At an early date, prospective goals are met for a vocation which will be within the range of the child's capacity. The large majority of the crippled enrollment is made up of children that science can never make normal. They have no active disease, but there is a deformity which will keep the crippled child in the special room as long as he goes to school. They need a complete system of special classes. So few of these children look forward to higher education that the main purpose of special education is to prepare each one of them to support himself. Practically all cripples may be made self-supporting and rendered capable of leading happy and useful lives.[69]

Such guidance prevents the emotional jar which frequently comes with adolescence when the crippled boy or girl begins to realize that he or she will never be like his or her able-bodied brothers or sisters. They learn to face their disability in an objective manner and develop through strength rather than weakness. There are fewer boys with paralyzed limbs planning to be football players; fewer spastic girls hoping to be movie actresses. Facing reality gives them a greater feeling of security than could ever be gained through living in a dream world until necessity demanded that an adjustment be made to adult surroundings. The supreme goal in the education of the crippled child is the construction of a well adjusted personality.

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Notices

Examinations for membership will be held in February. All applications must be in by January 15, 1936. Applications received after that date will not be considered in the February group.

The Council on Education of the American Medical Association is progressing with its work of surveying schools. The curricula of all the schools is being studied by your chairman of education, and the recommendations for a revised minimum curriculum being considered.

As soon as the material is ready for publication it will be in the Review.

EDUCATION COMMITTEE: ATTENTION!

Will the chairman of all the education committees please send to me their program for 1935-36? If you have any problem or suggestions concerning programs or education please include them.

Mildred Elson, Chairman,
Committe on Education.

The Physiotherapy Review

Editor-in-Chief: IDA MAY HAZENHYER

Assistant Editor: MARGUERITE SVEBILIUS

Business Manager: GERTRUDE BEARD

Associate Editors

MARTHA E. HINDMAN
342 Lowry Bldg., St. Paul, Minn.

SUE ROEN
2417 So. Hope St., Los Angeles, Calif.

BLANCHE B. SINN
112 E. Providence Rd., Aldan, Pa.
Clifton Heights P. O.

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Suggesting a Sideline

"How are the brains to be strengthened, the sense quickened, the genius awakened, the affections raised—the whole man turned to the best account for the cure of his fellow man? How are you, when physic and physiology are increasing so marvelously, and when the burden of knowledge,—is so infinite: how are you to—bear up under all, and use it as not abusing it, or being abused by it?"

The above is a quotation from an essay by Dr. John Brown, and reprinted by Northwestern University Medical School for the benefit of its students. Someone has recognized the necessity of avoiding a one-track-mind situation among students who will soon go out to be doctors; someone has realized that a doctor needs an outlet and an insight into some attraction outside of his profession in order that "the brains be strengthened, the sense quickened, the genius awakened, the affections raised—"

May we offer this same suggestion to members of our own profession. For though we do not have the same deep responsibility that a surgeon has when he holds a life under his scalpel, yet, with the physical eye, we do look upon the deformed side of life, and our work is governed largely by the hard, cold facts of science. Easy it is, unless one is on the guard, to be swept by the tide into one of two courses.

On the one hand, there is the course in which nothing but physical therapy appears. All knowledge and all effort are bent upon the profession, and the profession rules the life until the life abuses the profession by taking from it the "affections" which make it a human force instead of a mere machine. The patient is only a "case" which is to be repaired much as an automobile is serviced, and the technician takes pride in the workmanship as a good mechanic takes pride in his trade. On the other hand, there is the course in which the workers themselves become abused by the profession because the work "gets the best of them." It saps all their vitality and leaves no energy for any other part of life.

How to avoid these extremes! Again we quote from the above essay: "If our young medical students would take our advice, and for an hour or two twice a week take up a volume of Shakespeare, Cervantes, Milton, Dryden, Pope, Cowper, Montaigne, Addison, Defoe, Goldsmith, Fielding,—etc., not to mention authors on deeper and more sacred subjects—they would have happier and healthier minds, and make none the worse doctors—"

In other words, to avoid becoming lop-sided, to keep the mind healthy and the spirits lifted, to make life all-around worth while, do something besides physical therapy when the day's work is done. Whether it is reading the above authors, or daubing in paints or music, or week-ending "far from the madding crowd," or raising a certain kind of chrysanthemum or cucumber in the back yard—*do something.* For then, when the day's work has gone wrong, when physical therapy has seemed inadequate—and such days do come to all—you still have your sideline to take you through the rest of that day; and your physical therapy will look much, much brighter the following day.

A New Chapter

On Saturday the twelfth, 1935, physical therapists from all parts of Ohio met at Lakeside Hospital in Cleveland for an afternoon and evening meeting. The purpose of the afternoon session was to organize the Ohio Chapter of the American Physiotherapy Association. The chapter will be divided into districts according to the geographical distribution of its members. Cleveland will form one district of the chapter and Columbus will form another district. After the constitution and by-laws had been adopted, election of officers took place. The meeting was well attended and all members seemed much interested in the future of the newly organized Ohio Chapter. At the close of the afternoon session a dinner was enjoyed by the Ohio group at "Green Gables."

At the evening meeting a very interesting program was given. Mr. H. van Y. Caldwell, executive secretary of the Cleveland Academy of Medicine, discussed the advantages of professional group organizations. Dr. Robert Stecker of Cleveland City Hospital gave a talk on Fever Therapy with the Hypotherm (illustrated). Dr. Clarence Heyman, Associate Professor of Orthopedic Surgery, University and Mt. Sinai Hospitals, and Orthopedic Surgeon at Gates Memorial Hospital, Elyria, Ohio, spoke on Orthopedic Operative Procedures.

Ohio Chapter.

ABSTRACTS

John S. Coulter, M. D.

The Present Status of the Problem of "Rheumatism"

A Review of Recent American and English Literature on "Rheumatism" and Arthritis

Philip S. Hench, M. D., F. A. C. P.; Rochester, Minn.; Walter Bauer, M. D., F. A. C. P., Boston; Almon A. Fletcher, M. D., Toronto; David Christ, M. D., F. A. C. P., Los Angeles; Francis Hall, M. D., F. A. C. P., Boston; and Preston White, M. D., Charlotte, North Carolina. In Annals of Int. Med., 8:10:1315, Apr., May and June, 1935.

Rheumatism, using the term in its broadest sense, has just been designated "Public Enemy Number Ten" by the United States Department of Public Health. Over the world similar departments are placing this disease-group high on the list of those which present a major challenge to the medical profession and public. Chronic arthritis, the most common form of "rheumatism," is the greatest single cause of disability in temperate climates, and it produces more pensionable invalidism than any other condition except cardiovascular disease of old age. In spite of the fact that chronic arthritis is the oldest recorded disease, the medical profession has to a considerable degree ignored it. Because of this indifference, there has long existed an attitude of pessimism concerning it.

Many have called attention to the relatively greater disability from rheumatism than from tuberculosis. In the past fifty years, curves of disability for tuberculosis have fallen sharply, whereas those for rheumatism have risen. Buckley cites the records of a large German medical benefit association to the effect that the proportion of sufferers from rheumatic disability begins to exceed that of tuberculous children who are still of school age, but that by the age of twenty it is more than five times as great. In Germany there is three and a half times as much rheumatism as tuberculosis. Arthritis imposes upon the Swedish Pension Board an economic burden more than twice as heavy as that arising from tuberculosis. More than twelve per cent of its funds are for chronic articular rheumatism. In Sweden 35,000 persons (0.6 per cent of the total population) are disabled by arthritis, and it is responsible for a yearly cost to the State of six million crowns (about $1,500,000, Kahlmeter). As Copeman states, the position of tuberculosis fifty years ago was similar to that of the far more costly, but less dramatic, rheumatic disease today. Tuberculosis has been conquered largely by teamwork between far-seeing laymen and physicians who are determined to rid humanity of such domination. The same result can be achieved in the case of "rheumatism, the Captain of Crippledom."

Treatment of gonorrheal arthritis.—Treatment must be general, to the original focus of infection, to infected joints, and for the septicemia or pyemia. Lees discussed the value of various forms of therapy: rest, diuretics, medicines, prostatic massage, urethral irrigations, foreign protein therapy, and various forms of physical therapy. In the acute stage, heat, rest, and immobilization are indicated, but movement and massage must be instituted as soon as possible to prevent permanent loss of motion (Lees, Ginsberg). The effects of high frequency currents (diathermy) to prostate gland and vesicles, as introduced by Cumberbatch and Robinson, have been disappointing to Lees who advocates "specific therapy" with "detoxicated vaccines." Delacroix is convinced of the value of radioactive mineral waters in restoring normal calcification to the affected bones.

Conservative (i.e., nonsurgical) measures are favored except in pyarthrosis, in which case arthrotomy is advocated (Lees, Neely). The value of irrigation is noted: with bichloride solution (LeBreton), with Pregl's solution (Thomson) and with warm saline solution. Ginsberg felt that benefit resulted from injections of air.

The method of treatment that bids fair to supplant all others for gonorrheal infections, especially of joints, is hyperpyrexia by "superdiathermy," radiothermy, or hot air-conditioned cabinets. Since 1931 brief reports have appeared indicating that rapid sterilization of joints and the genitourinary tract can be accomplished if by these means the patient's temperature can be elevated long enough to reach or exceed the thermal death point of various strains of Neisseria gonorrheae. The thermal death time of fifteen or more strains of gonococci in vitro has been determined as about five hours at 41 or 42 C. (Carpenter, Boak Mucci and Warren). A few strains are more resistant and need the same temperature for longer periods or a higher temperature for shorter periods. Carpenter and Warren treated patients with gonorrheal arthritis with radiotherapy and superdiathermy. Patients were "usually cured," although in one case there was complete failure after seven hours of heat at 41.5 C. In this case the thermal death point of the gonococcus isolated fom the joint was much higher than the amount of fever induced in the patient. Nine patients were treated by two fever sessions of five hours each with "very encouraging results" by Bishop, Horton and Warren. Acute arthritis subsided rapidly, redness and tenderness disappeared, and mobility was gradually restored. Chronic arthritis became painless and there was gradual relief from stiffness. Tenney believes that if a temperature of 106 F. is maintained for two to four hours, it acts almost as a specific against gonorrheal arthritis, as he believed the thermal death point of the organism to be about 104 F. In two cases in which the patients were treated by Warren and Wilson symptoms subsided entirely after one or two sessions of fever at 41.5 C. for five hours.

A patient of Berris with acute gonorrheal arthritis received no relief after four treatments each at 103 F. for four hours, but a patient with "probable gonorrheal arthritis" of six months' duration obtained complete relief after six treatments at 102 F. for three hours. Simpson, Kislig and Sittler obtained gratifying results in the treatment of gonococcal and other types of infectious arthritis using radiothermy and later an improved hot air-conditioned cabinet. Atsatt and Patterson treated eight patients with gonorrhea of the joints and genitals by general diathermy. In all eight cases the arthritis was cleared by one to five treatments, at temperatures not over 103.5 F., for periods of five hours or less, and in all but one case negative smears were found

thereafter. For opinions on the virtue of different methods, varying lengths of fever sessions, prevention of reactions, and contraindications and so on, reference should be made to papers cited.

Rest, activity and physical therapy.—The value of physical therapy and the principles of its application are being increasingly recognized, but are worthy of constant restatement (Coulter, Ray, Buckley, Kovacs). Rest is looked upon as the most potent single therapeutic procedure at our command, but rest does not necessarily mean bed rest. The latter, improperly carried out, may nullify its purposes (Minot). The arthritic patient who must be put to bed or kept physically quiet must not be allowed to remain wholly inactive or increased muscle atrophy, flexions, and other deformities may result (Pern and Munk). A judicious balance must be made, therefore, between mental and general bodily rest and rest for inflamed joints and muscles on the one hand, and nontraumatizing physical activity on the other. For an acute exacerbation, Anderson feels that a maximum of a week or two in bed is generally sufficient; more may be dangerous.

While the more common types of physical therapy, such as dry heat, diathermy, massage, and exercises, are of great value, the pool bath in which patients may use muscles and joints in the water is of special value and should be more available (Ray, Lautman). The "glove bath," a variation in the application of heat for painful hands and feet, is described by Ray. The hands, enclosed in rubber gloves or the feet in rubber socks, are immersed in hot water at a temperature of 105 to 110 F. for twenty to thirty minutes daily. Buckley advises cold baths for robust patients, warm baths followed by brief cold effusions for less robust patients. Prolonged and habitual hot baths lessen the skin's diminished power to react promptly to its environment. The merits of various types of physical therapy are presented: Pistany mud (Schmidt), infra-red rays, roentgen ray treatments, and "fever therapy" (Dausset and Lucy).

Fever therapy.—In the light of subsequent events it has become the fashion to consider that foreign protein therapy, such as typhoid vaccine intravenously, was the first modern form of fever therapy, although it is not at all certain that fever was responsible for its benefits. Fever therapy is the "newest" form of physical therapy. Following malaria treatment, fever has been induced by "super-diathermy" radiothermy, hot air-conditioned cabinets, and hot baths. Markson and Osborne in 1933, and also in 1931, induced by diathermy a temperature of 103 to 104 F. for seven to eight hours in the treatment of "chronic infectious arthritis." One fever session a week was given for eight weeks. In six cases, two patients were "markedly improved," three were "improved," and one was not improved. "Striking results" were obtained by King in an unstated number of cases of both atrophic and hypertrophic arthritis. Relief from pain and increased mobility were noted by all. In some cases a "cure" was simulated. Other patients were only moderately and temporarily benefited. Even "after complete relief has been attained," further fever sessions every few days are advocated by him to prevent recurrences. Speed noted some marked improvements although at times relapses occurred (no figures given).

Carpenter and Warren believe that arthritic patients respond better to fever provoked by diathermy than by radiothermy. Using diathermy, Bishop, Horton and Warren gave twenty-six treatments to fifteen patients with chronic infectious arthritis. Two fever sessions of five hours each were given. Results were "very encouraging" in sixty-three cases of atrophic or hypertrophic arthritis treated with radiothermy by Tenney. At the end of eight months, seven patients were symptom-free, forty-eight were definitely improved, eight were unimproved. Pope favors the use of hot baths or diathermy, and noted that at first "arthritics have their pains and stiffness greatly increased." Coulter favors diathermy hyperpyrexia but uses hot baths to lower the cost of treatments. Berris, using heated cabinets, treated eleven patients with atrophic arthritis with three sessions a week for three weeks. Three patients obtained "complete relief," and the majority were "definitely improved." About sixty patients with atrophic arthritis seen by Simpson, Kislig, and Sittler were each given two fever sessions at 104 to 105 F. for four to five hours by radiothermy and heated cabinets. Thirty per cent believed they had experienced a complete remission, an additional thirty per cent were "satisfied with the result." Forty-three patients were treated by Kohn and Warren. Only one or two fever sessions were given to each. Benefit was obtained by thirty-five patients; pain rapidly diminished and mobility of joints increased. Eight were able to earn a living. Relapses within one to two years occurred with three patients who were relieved by further treatment.

Favoring diathermy electropyrexia, Markson and Osborne reported further results in the treatment of nineteen patients. They insisted that eight treatments at a temperature of over 104 F. for eight to ten hours, are required. Of the ten patients so treated, seven (70 per cent) were benefited; complete relief was noted by one patient for fifteen months, one for twenty-one months, two for twenty months; three were "improved" for twelve to fourteen months (end of observation period). Of nine patients treated with shorter sessions (four hours), fifty-six per cent were improved; five were definitely improved for three months or longer; three were improved for only one month. In a small series of cases (numbers omitted) Kowacs noted failures and encouraging results equally divided. Patients with atrophic arthritis do not stand as high temperatures (not over 104.5 F.) as comfortably as those with gonorrheal arthritis. Auclair noted complete failure in only seven of eighty cases of various types of "rheumatism" (no details given).

Cecil's results "have been rather disappointing," and he believes that the wave of enthusiasm for hyperthermia in arthritis is not justified. In a limited series (number not stated), no benefit was noted by some, only temporary effects in others; in a few cases improvement was apparently permanent. Kinsella noted only temporary relief in an unstated number of cases.

Physiologic effects from fever therapy by various means seem to be about the same. The pulse rate rises to one hundred and thirty to one hundred and fifty. Blood pressure rises, then falls. The electro-cardiogram shows contractions of lowered voltage (reduction of amplitude). The leukocyte count may show an initial drop within two hours, and may then rise to 15,000. There is no change or, due to dehydration and concentration, only a slight rise in blood urea, uric acid, sugar, creatinin, and calcium. There is a loss of carbon dioxide with a tendency to slight alkalosis and an increase in the ph of blood. The most noticeable alteration is that discovered by Simpson and his colleagues: marked loss of chlorides from blood and tissues. Patients lose from twenty to twenty-six gm. of sodium chloride with each session; there is no free hydrochloric acid in the stomach and the blood chlorides fall forty to one hundred mg. Simpson feels that chloride loss in sweat is responsible for symptoms of exhaustion, fatigue, nausea, vomiting,

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abdominal cramps, and muscular twitching, occurring during and after fever sessions, and that they are all practically eliminated by supplying by mouth large quantities (four to six liters) of chloride-containing fluids, such as iced 0.6 per cent saline solution.

In conclusion, reports to date have in general concerned themselves with small numbers of cases, observed at most for about one to two years. The number of sessions advocated has varied from one or two, to eight, or as high as twenty, sessions being given from one to three times a week. Whereas diathermy and radiothermy were the original methods of choice, there has been a reaction in favor of simpler and less expensive methods, such as heated air-conditioned cabinets. Results have been variable: "disappointing" to some, with "eighty-seven per cent improvement" and not infrequent "cures" reported by others.

Hypertrophic Arthritis

Physical therapy.—The usual methods of heat, massage, and mild exercises are approved. A judicious ratio between rest and moderate activity is generally advised, with a little more emphasis on rest and the use of crutches, canes or caliper splints as necessary to reduce trauma to involved hips or knees (Ray, Miller). Manipulation is favored by Douthwaite for certain affected hips, but it is decried by Crowe who also does not favor massage or calipers. For stimulating circulation in Heberden's nodes Elliott advises violin playing or similar use of the hands, and he reports the reduction of nodes by the pressure of adhesive or other plaster, bandages, or metallic bands intermittently applied.

Spondylitis

Treatment.—The treatment in general is the same as that described for atrophic or hypertrophic arthritis, with braces and corsets as necessary. For painful cervical arthritis Bisgard favors immobilization in a Thomas collar for several weeks with daily traction, and also roentgentherapy. Rest is not advised by Pockley in cases of "kinked back" or in cases of acute or chronic lumbago. Rapid and complete relief can be obtained in two days in acute cases if the patient has the fortitude to perform repeatedly the movements that cause most pain. The movement most usually effective is that of repeated dorsiflexion, extension of the back as far as possible. In chronic lumbago such treatment is equally good, but it takes a "few days longer."

Treatment of fibrositis.—The treatment of muscular fibrositis is essentially similar to that of other forms of rheumatism: rest and heat, removal of foci, proper clothing and climate, analgesics, and sometimes vaccines. Buckley approves of the use of a hot flatiron applied to the back over a layer of thick brown paper when less primitive measures are not readily available. Sunshine is more useful in fibrositis than in arthritis. Roentgentherapy relieved sixty-five per cent of thirty-four patients with lumbago who were treated by Kahlmeter.

Tendinitis.—Tendinitis may appear as part of atrophic arthritis, gout, or rheumatic fever, but it is often an independent entity. Kahlmeter has discussed the various forms of localized and general tendinitis. Subdeltoid or other calcareous bursitis may in fact be localized tendinitis, other examples of which may be seen at tendon insertions of the treat trochanter, the inside aspect of the knee, and the calcaneal spur. "A little known but not uncommon form" is that at the insertion of the quadriceps tendon at the upper border of the patella. Roentgentherapy is his favorite treatment, heat and massage being "rarely of any use." Kahlmeter considers trauma the most likely cause of quadriceps tendinitis.

Treatment of sciatica.—Ultimate success in treatment obviously depends on determining the likely one of the many causes noted. In general, rest in bed, heat, and analgesic drugs are indicated. Epidural injection is advised if these do not suffice (Gardner). Later detailed investigation must follow the acute phase. Treatment varies with the findings. Immobilization by strapping with adhesive plaster or casts may be necessary (Gardner, Williams). When significant symptoms recur, in appropriate cases Williams favors lumbosacral fusion. The results of various treatments and combinations of treatments of one hundred and fifty-nine cases of sciatic pain of indeterminate origin were analyzed by Craig and Ghormley; of these, one hundred and seventy-seven patients were ambulatory, forty-two bedfast. In the former group of eighty treated with epidural injections alone, only fifty-two percent were completely relieved. Obviously, other measures are indicated. Diathermy alone completely relieved thirty-three per cent of thirty-six patients; a belt and diathermy completely relieved thirty-three per cent of fifty-two patients. Injections and diathermy helped more, but the best combination was the use of epidural injections, diathermy, and a belt, by means of which eighty-five per cent of the group so treated were completely relieved. Of those confined to bed, eighty-six per cent of twenty-eight patients were completely relieved by the use of a double Buck's extension, diathermy, epidural injections, intravenous foreign protein, and removal of foci. Of fourteen patients treated similarly except that epidural injections were omitted, sixty-three per cent were completely relieved. Thus epidural injections gave added relief. They are also approved by Fulcher, Fletcher, J. F. Miller, and Bankhart. Forty to sixty cubic centimeters of a one per cent solution of procaine hydrochloride seem favored.

Low Back Injuries

John R. Vasko, M. D., Great Falls, Mont., in Jour.-Lancet, LV:12:372, June 15, 1935.

The success of treatment in the low back sprains depends largely upon the degree of injury. The minor sprains will usually respond to taping up the back, rest, and physical therapy. The duration may be only a few days until relief is complete. This applies to all types of sprains. The most troublesome and resistant are the sacro-iliac and lumbo-sacral sprains. These are notorious for their resistance to treatment, some cases refusing to respond to the entire conservative treatment armamentarium. Here again it is advisable to try the conservative treatment first, either the ambulant or recumbent.

Ambulatory treatment consists of taping the lower back to immobilize it, rest, and then physical therapy consisting of heat and massage or diathermy and massage. Conservative recumbent treatment consists of bed rest with traction either on the legs or the pelvis, partial immobilization and physical therapy. The patient should be kept in bed from two to six weeks with traction depending upon the symptoms. He is then allowed up on crutches with some support, usually a reinforced lumbo-sacral corset with shoulder straps and a lumbar pad. Physical therapy is continued.

After six to eight weeks if improvement is not forthcoming, the next step should be taken, that is, the manipulative treatment. Bankhart, of England, uses manipulation in all his cases, even the acute, and he reports very good results. My experience with manip-

ulation also has been uniformly good. The patient is given either a spinal or ether anesthetic and the lower spine thoroughly manipulated in all directions. Flexion, extension, lateral bending, and twisting of the lumbar spine are made through the normal range. Also the lower extremity, with knee extended and pelvis fixed, is flexed upon the abdomen to such degree that the ankle touches the forehead. This is done slowly with massage of the hamstring muscles and should require at least twenty minutes for each side. No rapid forcible motions should be done for fear of fracturing a bone or rupturing a muscle. This latter stretching breaks up adhesions, stretches the sciatic nerve, releases contracted muscles and sometimes causes a loud click, which some authorities believe to be the reduction of a subluxated sacro-iliac joint. The patient is then immobilized in a double plaster hip spica—some men think bed rest alone, with or without traction, to be sufficient. After two weeks of bed rest, the patient is allowed up with support, a reinforced corset, a steel brace or a plaster jacket; the more chronic the case has been the more rigid the support. Crutches should be insisted upon for two or three weeks and only then should the entire body weight be allowed to be borne by the feet.

It should not be forgotten that foci of infection ought to be removed just as in arthritis. An infection elsewhere in the body sometimes causes a sacro-iliac sprain to be very resistant to treatment.

Another conservative method of treatment is the epidural injection which is made into the sacral canal just above the coccyx. This is done under local and from 20 to 60 cc. of one-half per cent novocaine or normal saline is slowly injected into the epidural space. Sometimes the patient will obtain relief with one injection, others with several injections, and still others never get relief with this method. The simplicity of the method and frequent good results should encourage its trial.

After one or more courses of conservative treatment have been tried and still the pain continues, operative fusion of the affected sacro-iliac or lumbo-sacral joints should be considered.

Aids in Muscle Training

With Special Reference to Sling Suspension and Underwater Exercises

F. J. Gaenslen, M. D., Milwaukee, in J.A.M.A., 104: 12:1002, March 23, 1935.

Of the many varieties of physical therapy, active exercise probably deserves first place because of its wide applicability and because it calls into play the entire neuromuscular units in a manner approaching normal physiologic action.

Sling suspension exercises.—Some ten years ago I described the "sling suspension" method of exercise as an aid in restoration of muscle power in infantile paralysis. The method has been employed for this condition ever since and has also been found useful in many other conditions. Briefly, the method consists in supporting the arm or leg to be treated in a sling suspended from overhead, thus eliminating the weight of the extremity as a hindrance during movement. The adaptability to the upper and lower extremities, as well as the fact that the method can readily be taught to nurse or mother, makes further mention of the method worth while. These exercises are helpful in allowing the patient to translate even minimal and scarcely appreciable muscle power into active and readily demonstrable motion through a fair arc. The fact that even slight gains are recognized by the increase in range of motion is of great importance in spurring on the instructor and the patient to continued efforts in the long and tedious process of restoration of muscle power.

Other conditions in which sling suspension may be employed with benefit include spastic paralysis, especially of the lower extremities, and atrophic arthritis, as well as in cases of weakness and stiffness after fracture or injury. In spastic paralysis it has frequently been found of advantage to attach a heavy weight to the sling, transforming it essentially into a pendulum with heavy weight. The patient's arm or leg is placed in the sling and the pendulum is put into motion by the instructor, the patient being taught to continue the swinging with and without resistance. It is felt that a good start may be made in this manner in developing the sense of rhythm and in the teaching of gentle coordinate movement.

In arthritis, active motion within the pain-free range is without doubt a factor of considerable importance in the maintenance of normal physiological joint activity. The alternate contraction and relaxation of muscle groups and their antagonists must be of help in improving the circulation. As the muscles contract, the lymph vessels and veins are compressed, the blood and lymph being hurried in the proximal direction. As the muscles relax, these vessels are filled from the capillary side, the capillary system in turn drawing on the arterial supply. In this manner capillary stasis is overcome, and definite acceleration of the blood stream results.

Underwater exercises.—Of perhaps equal importance as an aid in muscle training are underwater exercises. While suitable for infantile and other types of paralysis, atrophic arthritis, and weakness and stiffness of the extremities after injury, this type of exercise will be found useful as well in many instances in the field of internal medicine, neurology and psychiatry.

Overhead trolley system.—By means of an overhead pulley, the patient is gently hoisted on a hammock from the bed and carried by trolley to a position directly over the tub, and then gently lowered into the water. Underwater massage and active and passive exercises, as well as resistance exercises, are then readily administered according to the needs of the individual case. Aside from the facilitation of motion due to the warmth and buoyancy of the water, nervousness is allayed and the patients frequently drop off after the bath into a sound sleep. The need for narcotics is diminished and the patient is spurred on to increased effort by the realization that definite and rapid progress is being made.

While the beneficial effects of such simple exercises for normal as well as injured parts are readily appreciable to the patient, as well as to the physician and attendants, and presumably attributable to improvement of circulation, it is desirable to have some scientific explanation for this improvement. Moving pictures of the circulation in the rabbit's ear and the effect of a rise of surrounding temperature on the circulation, prepared by Drs. Elliot R. Clark and E. A. Swenson of the anatomy department of the University of Pennsylvania, are of interest in this connection. These show that, while at ordinary temperature the circulation through the capillaries is slow, one may say sluggish, a moderate rise in temperature is accompanied by a very marked increase in the rate of flow. That exercise exerts a similar influence is indicated graphically in the charts prepared at the Mayo Clinic, based on the work of Goldschmidt and Light. These show that the number of open capillaries in a given area of skin surface is more than doubled by exercise and that heat also increases

their number, while cold decreases their number in marked degree. In this connection, too, the work of Wright and Marquardt is of interest. They studied the capillaries in the nail bed of the finger and found that while in a normal, active individual the capillaries were rather closely packed in hairpin-like loops, those of the crippled arthritic hand were much less numerous and narrower, indicating that the little used, crippled hand was receiving a minimum of blood.

Atypical Muscle Strain

P. Bauwens, M.R.C.S. Eng., Medical Officer in Charge, Electrotherapeutic Department, St. Thomas's Hospital, and Hon. Electrotherapeutist, the Royal Westminster Ophthalmic Hospital; and James K. McConnel, D.S.O., M.C., Lt.-Col. (Rtd), Biophysical Assistant at St. Thomas's Hospital, London. In The Lancet, CCXXVIII:5833:1384, June 15, 1935.

The following are put forward as the arguments on which the essay is founded:

Argument

1. Pain which may reach great severity often arises from atypical muscle strain.
2. The sites of these strains are often overlooked, because the usual signs of muscle strain are frequently absent, and often the pain is ascribed to coexistent conditions.
3. The cause of atypical muscle strain is unsatisfactory repair of soft structures due in general terms to ill-health, deficient circulation locally, to chronic local fatigue of muscle, and incoordination.
4. These atypical strains can be located with certainty by simple electrical tests.
5. Satisfactory results from treatment demand a reasonably good state of health, so that the appropriate local remedies may take effect. Bad muscular habits which induce local muscular fatigue must be adjusted.

Characteristics of Atypical Muscle Strain

Of the characteristics from a clinical point of view the first four are of special importance.

1. Lack of tenderness to pressure.
2. Delay before the patient experiences pain due to the atypical strain. This delay is sometimes a matter of weeks.
3. Absence of pain on passive movement.
4. Absence of objective physical signs, such as swelling or redness.
5. Diffuseness.
6. Another distinction between the acute and this atypical form of muscle strain is the absence of pain on active movement, which is often a characteristic of the latter. This absence of pain does not preclude the existence of strain in a muscle because, when a muscle contracts during a voluntary movement, only a portion of its fibres are brought into use.
7. In some cases after these strains have been cleared up an increased range of joint movement has been reported by the patient, and is noticeable to an observer.
8. Absence of tenderness to touch and other recognized signs of muscle strain may lead to the pain being ascribed to another factor, especially if some disability such as gross osteo-arthritis of the hip joint is coexistent.

Causes of Atypical Muscle Strain

1. Trauma during ill health.
2. Stasis and poor blood supply.
3. Weakness and incoordination.—Atypical strains are also found in weak and incoordinate muscles on which a heavy load is suddenly thrown.
4. Local chronic fatigue in hypertonic muscles predisposes to atypical strain in muscle in the following manner. Normal muscle tone implies a state of slight constant tension which is caused by individual muscle fibres contracting in rotation.

Detection by Electrical Tests

Hypersensitive areas associated with atypical muscle strain can be conveniently located by two methods. The first is by means of minimal faradism using the current drawn from the Smart-Bristow coil. This is convenient, because this coil is in constant use and is well understood. As already described, the patient notices differences of sensation when the current is passed through normal muscle. The peculiar sensation of pain when the electrode is applied to the area of strain, is never confused by the patient with the normal sensation of faradism. The minimal faradic test uses a low voltage current, and the amount of the current which passes to the muscle under test depends on the electrical resistance of the overlying tissues. If the horny layer is thick, if it is patchy—as when local exposures of ultraviolet ray have been given—if the patient is very fat, or if the muscle in question lies very deep, the results of the test may be hard to evaluate.

The second method is to use a current which reaches the damaged muscle without being affected by variations of resistance of the superficial tissues. This is achieved by fully rectifying an alternating current without any smoothing, and controlling it by regulation of the filament current of the rectifying valve. This current being of a unidirectional pulsating nature has an added advantage of being easily measured by means of an ordinary milliammeter. It may conveniently be called "rectified A. C."

When using this rectified current for testing, it is essential to keep constant the area of contact between the electrode and the patient's skin. Thus, considerable care is needed, when testing over prominent bony points, such as the epicondyle of humerus. If this area of contact is kept constant, there is no possible risk of using an excessive current flow or density, as with a suitable arrangement of resistance control of the patient's current is most satisfactory. The method has advantages over the faradic current.

Local Remedies

A satisfactory choice of local remedies often gives results in a single treatment, but to achieve this localization of the site of atypical strain is essential so that the beneficial effect of the treatment is not wasted on other areas. It is of relatively little value to treat an area of referred pain as compared with treating the site of the atypical strain, hence the great importance of the electrical tests in all but the simplest cases.

Two remedies for atypical strain which are generally efficacious are local doses of ultraviolet rays and histamine ionization. The effects of these are somewhat similar because local doses of ultraviolet cause a liberation of small quantities of vasodilatory substances over a long period, producing the characteristic "triple response."

Massage, radiant heat, infra-red rays or diathermy (either short or long wave) often do not succeed, and may even exacerbate the pain. They may, however, prove useful adjuncts to local doses of ultraviolet or to histamine ionization.

Restoration of Muscle Balance and Normal Relaxation

The adjustment of faulty muscular habits which

produce chronic fatigue in hypertonic muscles is, as a rule, simple, even with the elderly and decrepit, but not so with the usual method of repeating the desired movement or posture as an exercise, because this deals with one side of the problem only.

The Electrical Tests

A test for atypical muscle strain should be applied after each series of two or three treatments, when dealing with difficult cases, as this regulates the program of treatment outlined before treatment began. This is important when coexistent conditions are present and may themselves require attention, or when several areas of atypical strain appear to refer pain to the same distal area.

Penetration of Moist Heat Applied to the Abdomen and Its Effect on Intestinal Movements

Hjalmar E. Carlson, M. D., and Thomas G. Orr, M. D., Kansas City, Kans., in Arch. Surg., 30:6:1036, June, 1935.

The use of heat in the treatment of abdominal conditions, particularly peritonitis or localized abscesses, has become a frequent procedure in hospitals. Patients as a rule state that they feel better when such treatment is instituted, and the relief from pain which heat affords in intestinal or pelvic conditions is commonly known.

Some conflict of opinion is evident in the literature concerning the effect of heat applied locally to the abdomen. Among those who have found a rise in temperature within the abdomen after the application of heat to the outside of the abdomen are von Ewald, von Brieger, Wendriner, Wintermitz and E. Eichler and Schemel. These authors used hot steam or jets of hot water to induce the increase in temperature. Chelmonski, using hot water bottles, induced a rise of 2 C. within the abdomen, while Stengel and Hopkins, using the same method, found the results negligible. Hepburn and his associates, using hot water bags, hot wet packs, electric pads, irradiation with infrared rays and diathermy, were unable to increase intragastric temperature after applying heat for one hour or longer, except with diathermy, by which a rise of 1 F. was noted. No studies recording the effect of heat on intestinal movements have been found in the literature.

Experiments

Heat was applied to the abdomen by using two thicknesses of moist flannel beneath an insulated rubber electric pad. The heating system was covered with a layer of rubber sheeting to prevent the loss of heat. The heat was usually applied for one hour and in some experiments for three hours. The temperature of the pack ranged between 106 and 109 F. at its point of contact with the skin.

The first ten determinations were made on two mature dogs weighing 10 Kg. each by taking the temperature with a long thermometer through the anus in the midcolon and in Thiry-Vella jejunal loops with the same mercury thermometer before and after heat had been applied for one hour. The abdomen of each animal was shaved, and the dogs were allowed to be in the room in which the experiments were carried out for at least an hour. The animals had had no food for at least twelve hours before the experiment was begun. The body temperature was taken through a slit in the axillary fold.

Fifteen determinations were made on three adult patients by taking the temperature in colostomy openings before and after the application of heat for one hour. The oral temperature was also recorded. Five observations were similarly made on a nine year old child weighing 25 Kg. to determine the difference in effect produced by the thickness of the abdominal wall. These determinations were compared with five determinations made on a dog which weighed 25 Kg. Five observations were made on an adult having an infected suprapubic cystotomy wound to determine any difference in the conduction of heat between infected and non-infected areas. In each of the five patients studied the effect of heat applied for three hours was also observed.

The effect of heat on intestinal contractions was studied in the dog by applying heat to the abdomen and recording intestinal contractions on a smoked drum by means of a jejunal Thiry-Vella loop and a Brodie Bellows. Heat was also applied by injecting warm water directly into the Thiry-Vella loop.

Summary

Warm moist heat was applied to the abdomen of small and large dogs and a child for periods of from one to three hours in a total of forty experiments, and the temperature was recorded either in the colon or in an intestinal fistula. The effect of heat on intestinal contractions was noted in dogs with Thiry-Vella loops by the use of kymographic tracings.

It was determined that local applications of heat to the abdomen produce a rise in temperature within the abdomen if the abdominal wall is not too thick. Definite penetration was noted in the child and in the dogs, but the penetration in the adults was negligible. Prolonged application of heat did not increase the degree of penetration.

The application of heat to the abdomen or of warm water to the intestine did not affect intestinal tone or intestinal movements.

Book Reviews

ELECTROTHERAPY AND LIGHT THERAPY. By Richard Kovacs, M.D.; Clinical Professor and Director of Physical Therapy, Polyclinic Medical School and Hospital, New York, Physician in Charge Physical Therapy, City Hospital, New York; Visiting Physiotherapist, Manhattan and Harlem Valley State Hospitals and West Side Hospital; Consulting Physiotherapist, Hackensack Hospital and Mary Immaculate Hospital, Jamaica, New York. Cloth. Price $7.50. *Second Edition, Pp. 696 with 263 illustrations. Philadelphia, Lea and Febiger,* 1935.

Parts one and two of this volume beginning with elementary electro-physics lead up to the physics of the different electrical currents, consider the apparatus for their production, explain their action on the body and describe the technic of their application, the indications, contraindications and possible dangers involved. Part three considers the physics of radiant energy, the effects of the infra-red luminous and ultraviolet radiation; and the clinical application of heliotherapy and of artificial sources of light.

The final section discusses applied electrotherapy and light therapy in internal medical conditions, chronic arthritis and fibrositis; affections of the nervous system including the peripheral nerves, affections of bones, joints, muscles and tendons, and in eye, gynecological and genito-urinary conditions. There are sections on electrosurgery in urology by Daniel A. Sinclair, M. D.; proctological conditions by R. V. Gorsch, M. D.; dermatological conditions by Joseph Jordan Eller, M. D.; and diseases of the ear, nose and throat by Wallace Morrison, M. D.

The volume is orderly in arrangement, succinct and sound. The correlated or interchangeable use of other and often simpler physical measures is emphasized throughout. It is a useful volume to every physical therapist using electrotherapy and light therapy, since it explains the entire subject in a systematic manner. Its value is shown by the necessity of a second edition in three years, and the fact that it is used as a text book in schools for physical therapy technicians.

The book is recommended to physical therapists interested in these subjects as a conservative contribution of great merit.

ARTRITIS AND RHEUMATOIL CONDITIONS. By Ralph Pemberton, M.S., M.D., F.A.C.P. Professor of Medicine in the Graduate School of Medicine, University of Pennsylvania, Chairman of the American Committee for the Control of Rheumatism, Member of the Council on Physical Therapy of the American Medical Association, Physician to the Abington Memorial and Bryn Mawr Hospitals, Consulting Physician to the Philadelphia Orthopaedic Hospital and Infirmary for Nervous Diseases and to Chester County Hospital. Cloth. Price $5.50. *Second Edition. Pp. 455, illustrated with 69 engravings and a colored plate. Philadelphia, Leo and Febiger,* 1935.

The American Committee for the Control of Rheumatism states that the disease chronic arthritis represents one of the most important of existing social and industrial handicaps. In spite of etiological uncertainties, the Committee feels that properly managed therapy, which takes into account both infectious and metabolic factors, has yielded results which encourage optimism. In view of these statements a book on chronic arthritis should be of interest to every physiotherapist.

Pemberton believes that physical therapy has probably nearly as much value in the treatment of arthritis, in its early stages when all is said and done as any others at our disposal. The etiology, pathology and symptomatology of chronic arthritis are first considered. More than half of the volume is devoted to treatment, the coordination of treatment, the general considerations bearing on treatment, and the results of treatment of chronic arthritis.

Pemberton and his associates have done a large amount of laboratory and critical clinical studies on the use of heat, massage, exercises and electrical muscle stimulation in the treatment of chronic arthritis. So the chapter on treatment should be read by every physical therapist. In addition to physical therapy all lines of therapy are considered, and Pemberton warns that no single line of therapy can be laid down. He emphasizes that the profession and laity should beware of the man who approaches the subject of arthritis with single-minded enthusiasm, be it along medicinal, immunological, physico-therapeutic or any other lines.

This volume is the most critical and reliable book now available for students of this subject.

INTRODUCTION TO PSYCHOLOGY WITH SPECIAL APPLICATIONS TO NURSING AND NURSING PROBLEMS. By Edward S. Robinson, Professor of Psychology, Yale University, and Virginia Kirk, Director of Nursing, Emma Pendleton, Bradley Home, East Providence, R. I. Instructor, Yale University School of Nursing. Cloth. Price, $2.50. *Pp. 368, with 55 illustrations. New York, Macmillan Company,* 1935.

This book is intended to serve as a text for nurses. It presents the subject of psychology with a view toward teaching the nurse to better understand herself and her patient and "to think psychologically about a wide variety of human problems with which she will be confronted." After a brief description of the nervous system and its relationship to human behavior, the common psychological concepts of reflexes, habits, perception, ideation, memory, reasoning, feeling and personality are presented in unusually simple language. The style of presentation whereby each chapter is followed by a summary of the subject matter and a list of problems pertaining to the subject of the chapter may or may not meet with favor. The nurse or student, however, will find this book practical and understandable; an excellent introduction to an important and complex subject.

BACKACHE. By James Mennell, M.A., M.D., B.C., Medical Officer, Physico-Therapeutic Department, St. Thomas's Hospital. Second Edition. Cloth. Price, $3.50. *Pp. 227, with 59 illustrations. Philadelphia: P. Blakiston's Son & Co., Inc.,* 1935.

No symptoms are more common than those grouped under the term "Backache." Back pain is not mortal in its seriousness, but it brings more pain and chronic disablement than many serious diseases. Backache, in the majority of instances, is a symptom that is curable, but unless the most careful examination is made and the most accurate diagnostic methods are employed, the symptoms will persist and the patients will continue to seek and often obtain relief from the various cults.

Mennell in his work as an orthopedic physician, as distinct from that of an orthopedic surgeon, has seen an enormous number of sufferers from backache. He was convinced that exaggeration and imagination had less to do with the production of back symptoms than he had believed. In 1931 the first edition was issued presenting Mennell's methods for the study and treatment of backache, representing the work of eleven years. The favorable reception of the first edition lead to a French translation in 1933 and this second edition in 1935.

The first one hundred and thirty-six pages are devoted to the diagnosis of backache, including Mennell's ideas of history taking, examinations, diagnosis and differential diagnosis. The next seventy-one pages are devoted to treatment, and ten pages are given to a discussion of prophylaxis. Mennell gives a most complete method for back examinations that is well illustrated by line diagrams. This book can be recommended to every physiotherapist.

POLIOMYELITIS: A hand book for Physicians and Medical Students by John F. Landon, M.D. Attending Physician, Willard Parker Hospital; Special Consultant in Pediatrics, Women's Hospital, New York City; Assistant Attending Pediatrician, Roosevelt Hospital. Lawrence W. Smith, M. D., Pathologist, Willard Parker Hospital; Formerly Associate Professor of Pathology. Cornell Medical School and Harvard Medical School. $3.00. *275 pp. The MacMillan Company, New York,* 1935.

In a compact volume of 275 pages, Landon and Smith have presented an up-to-date treatise on the important malady of Poliomyelitis. The authors include considerable material from their own experience in the 1931 epidemic in New York. The subject of poliomyelitis is introduced with a concise historical review recalling the first reports of Heine and Medin, whose names, compounded, are often used to designate this disease. The following chapter on Etiology and Pathogenesis considers the various theories on the causative agent, the streptococcus of Rosenow, the globoid body of Flexner and Noguchi, and the more commonly accepted filterable virus. The discussion of the Pathology of Poliomyelitis is particularly excellent. The authors stress the concept that poliomyelitis is essentially a generalized infection involving other organs of the body in addition to the nervous system. The changes in the reticulo-endothelial cells of the body, in the liver, spleen, gastro-intestinal tract, etc., are commented upon. No mention is made however of the pathology in the muscles.

A chapter on Epidemiology is made unusually interesting. The symptomatology of infantile paralysis is usually such as to make diagnosis comparatively easy. The so called "abortive" and non-paralytic types, however, often present problems. Case reports are used freely to illustrate the clinical pictures and to stress points in differential diagnosis.

Of particular interest is the portion of the book, devoted to treatment. Prophylaxis, general care, serum therapy, x-ray, the use of the respirator, etc., are critically analyzed. A chapter on the after care of paralysis deals with the utilization of proper rest, graded exercises, apparatus, physical therapy and surgical procedures. This is followed by several appendices, in which comments on the nursing care of poliomyelitis and aseptic technique in the hospital are well worth careful perusal.

For those who deal with poliomyelitis, this book furnishes an excellent working knowledge of this disease.

THE DOCTOR'S BILL. By Hugh Cabot with an introduction by A. Lawrence Lowell. Cloth. Price $3.00. *Pp.* 313. *New York: Columbia University Press,* 1935.

The amount spent each year for tobacco alone is about twice the total gross income of all physicians. Cabot notes that although there is a widespread opinion to the effect that the present cost of medical care is high, the soundness of this view may be questioned if it should appear that a notable proportion of the money is spent in undesirable directions. This book is a discussion of the author's views of the applications of modern medicine to present needs.

The problems involved in the doctor's bill invite study by the economist, statistician, social scientist and the physician. The solution according to the author requires good tempered, patient and receptive discussion by several groups of experts. Dr. Lowell in his introduction says that this book should be read, not only by physicians, but also by laymen who want to know the questions confronting the treatment of individual and public health.

LIVING WITH THE WEATHER. By Clarence A. Mills, M.D., Ph.D., James T. Heady, Professor of Experimental Medicine, University of Cincinnati. Cloth. Price $1.50. *Pp.* 206. *Cincinnati: Caxton Press.* 1934.

This volume aims to show that weather acts as the basic factor in determining man's activities, and recurring abnormalities in the weather account for business cycles by directly affecting the physical and mental reactions of the population. Dr. Mills shows that two particular weather abnormalities have been found especially depressive, an unusual drop in storminess or day to day temperature variability and unseasonably high temperature.

The book is written in popular style with no attempt to present the evidence that support the various conclusions. A variety of subjects are treated such as "Flaming Youth and Early Age," "Human Behavior and the Weather," "Constipation and Intestinal Intoxication," "Weather and Disease" and "The Past, Present and Future of Man in His Relation to Climate and the Weather." The author states in the preface that an analysis of weather effects is presented and applications to everyday life is pointed out. This is done in an excellent manner, and it can be recommended to those interested in the part played by weather in their daily life.

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